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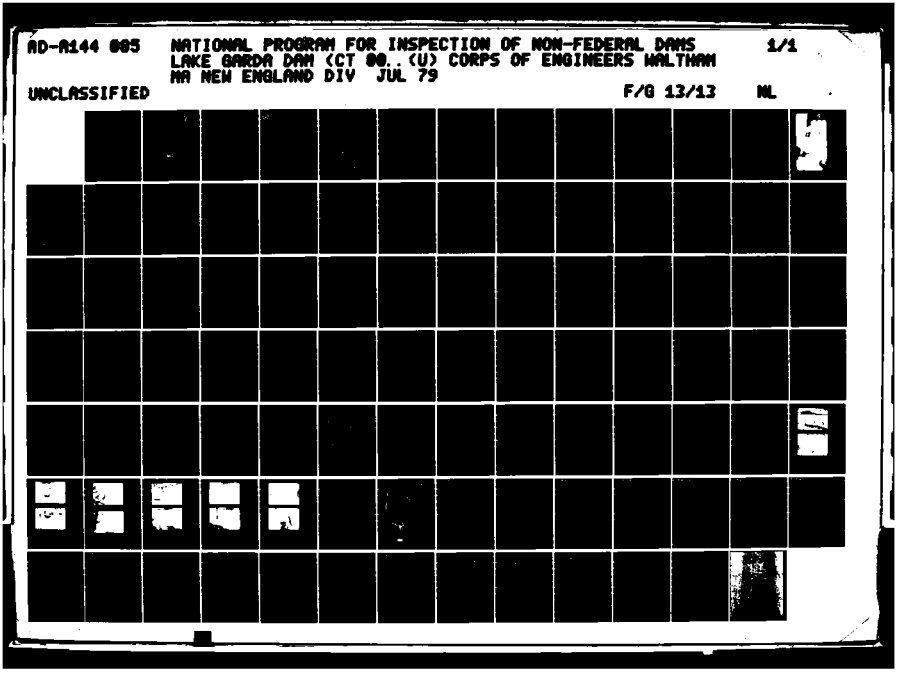

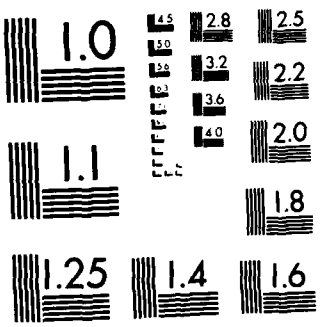

CONNECTICUT RIVER BASIN

FARMINGTON, CONNECTICUT

LAKE GARDA DAM
CT 00264

PHASE I INSPECTION REPORT
NATIONAL DAM INSPECTION PROGRAM

DEPARTMENT OF THE ARMY
NEW ENGLAND DIVISION, CORPS OF ENGINEERS
WALTHAM, MASS. 02154

JULY, 1979

UNCLASSIFIED

SECURITY CLASSIFICATION OF THIS PAGE (When Data Entered)

REPORT DOCUMENTATION PAGE		READ INSTRUCTIONS BEFORE COMPLETING FORM
1. REPORT NUMBER CT 00264	2. GOVT ACCESSION NO. AD-A144 685	3. RECIPIENT'S CATALOG NUMBER
4. TITLE (and Subtitle) Lake Garda Dam NATIONAL PROGRAM FOR INSPECTION OF NON-FEDERAL DAMS		5. TYPE OF REPORT & PERIOD COVERED INSPECTION REPORT 6. PERFORMING ORG. REPORT NUMBER
7. AUTHOR(s) U.S. ARMY CORPS OF ENGINEERS NEW ENGLAND DIVISION		8. CONTRACT OR GRANT NUMBER(s)
9. PERFORMING ORGANIZATION NAME AND ADDRESS		10. PROGRAM ELEMENT, PROJECT, TASK AREA & WORK UNIT NUMBERS
11. CONTROLLING OFFICE NAME AND ADDRESS DEPT. OF THE ARMY, CORPS OF ENGINEERS NEW ENGLAND DIVISION, NEDED 424 TRAPELO ROAD, WALTHAM, MA. 02254		12. REPORT DATE July 1979 13. NUMBER OF PAGES 50
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16. DISTRIBUTION STATEMENT (of this Report)

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18. SUPPLEMENTARY NOTES

Cover program reads: Phase I Inspection Report, National Dam Inspection Program; however, the official title of the program is: National Program for Inspection of Non-Federal Dams; use cover date for date of report.

19. KEY WORDS (Continue on reverse side if necessary and identify by block number)

DAMS, INSPECTION, DAM SAFETY,
Connecticut River Basin
Farmington, Connecticut

20. ABSTRACT (Continue on reverse side if necessary and identify by block number)

The dam is an earth embankment approximately 300 ft. long, the top of which is about 17 ft. above the bed of Unionville Brook. Based upon the visual inspction at the site and past performance, the dam is judged to be in poor condition. Based upon the size (small) and hazard classification (high) of the dam determined in accordance with Corps of Engineers guidelines, the test flood will be equivalent to one-half the PMF.

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DEPARTMENT OF THE ARMY
NEW ENGLAND DIVISION, CORPS OF ENGINEERS
424 TRAPELO ROAD
WALTHAM, MASSACHUSETTS 02154

REPLY TO
ATTENTION OF
NEDED

JAN 17 1980

Honorable Ella T. Grasso
Governor of the State of Connecticut
State Capitol
Hartford, Connecticut 06115

Dear Governor Grasso:

Inclosed is a copy of the Lake Garda Dam Phase I Inspection Report, which was prepared under the National Program for Inspection of Non-Federal Dams. This report is presented for your use and is based upon a visual inspection, a review of the past performance and a brief hydrological study of the dam. A brief assessment is included at the beginning of the report. I have approved the report and support the findings and recommendations described in Section 7 and ask that you keep me informed of the actions taken to implement them. This follow-up action is a vitally important part of this program.

A copy of this report has been forwarded to the Department of Environmental Protection, the cooperating agency for the State of Connecticut. In addition, a copy of the report has also been furnished the owner, Lake Garda Company, Inc., Unionville, Connecticut.

Copies of this report will be made available to the public, upon request, by this office under the Freedom of Information Act. In the case of this report the release date will be thirty days from the date of this letter.

I wish to take this opportunity to thank you and the Department of Environmental Protection for your cooperation in carrying out this program.

Sincerely,

MAX B. SCHEIDER
Colonel, Corps of Engineers
Division Engineer

Incl
As stated

CONNECTICUT RIVER BASIN

FARMINGTON, CONNECTICUT

LAKE GARDA DAM

CT 00264

PHASE I INSPECTION REPORT
NATIONAL DAM INSPECTION PROGRAM

DEPARTMENT OF THE ARMY
NEW ENGLAND DIVISION, CORPS OF ENGINEERS
WALTHAM, MASS. 02154

JULY, 1979

BRIEF ASSESSMENT
PHASE I INSPECTION REPORT
NATIONAL PROGRAM OF INSPECTION OF DAMS

Name of Dam:	LAKE GARDA DAM
Inventory Number:	CT-00264
State Located:	CONNECTICUT
County Located:	HARTFORD
Town Located:	FARMINGTON
Stream:	UNIONVILLE BROOK
Owner:	LAKE GARDA COMPANY
Date of Inspection:	APRIL 4, 1979
Inspection Team:	PETER M. HEYNEN, P.E.
	CALVIN GOLDSMITH
	THEODORE STEVENS
	GONZALO CASTRO P.E.

The dam is an earth embankment approximately 300 feet long, the top of which is about 17 feet above the bed of Unionville Brook. A concrete corewall runs along the axis of the dam and ties in with the spillway training walls. The crest varies in width from 40 to 90 feet, and is sparsely covered with grass. Several large trees are growing near the downstream edge of the crest. The concrete spillway crest, at the right end of the dam, is 29.5 feet long and about 3 feet below the lowest part of the top of the dam. The low level outlet is a 24 inch pipe through the dam controlled by a gate operated by a hand wheel floor stand located in a concrete block gatehouse on the upstream slope.

Based upon the visual inspection at the site and past performance, the dam is judged to be in poor condition. No evidence of structural instability was observed in the earth embankment, other than minor surface sloughing. Deterioration near the base of the right spillway training wall could have become a stability concern, but was repaired during the spring of 1979. Areas requiring attention include trees on the downstream slope and seeps at several locations along the toe of the downstream slope.

Based upon the size (small) and hazard classification (high) of the dam determined in accordance with Corps of Engineers guidelines, the test flood will be equivalent to one-half the Probable Maximum Flood (PMF). Peak inflow to the lake is 2375 cubic feet per second (cfs); peak outflow is 2000 cfs with the dam overtopped 1+ feet. Based on our hydraulics computations, the spillway capacity is 463 cfs, which is equivalent to approximately 20% of the routed test flood outflow.

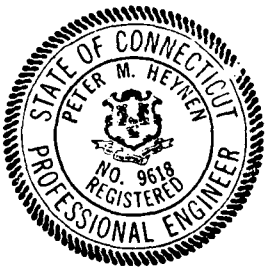
It is recommended that the owner initiate further studies to perform a more refined hydraulic/hydrologic study to evaluate the overtopping potential and spillway inadequacy of the project.

It is further recommended that a registered professional engineer qualified in dam design direct efforts to repair the deteriorated left spillway training wall. The engineer should investigate the stability of the wall as well, and prescribe any required corrective measures. The engineer should also develop plans and specifications for the construction of an adequately sized, paved discharge channel downstream of the spillway. The low level outlet pipe should be investigated and proper means should be developed for channelling its discharge to the downstream channel.

The above recommendations and any further remedial measures, which are discussed in Section 7, should be initiated by the owner within one year of his receipt of this report.

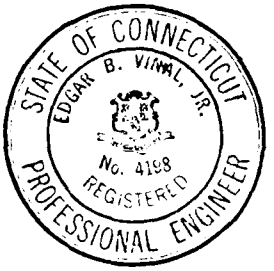
Peter M. Heynen

Peter M. Heynen, P.E.
Project Manager
Cahn Engineers, Inc.



Edgar B. Vinal

Edgar B. Vinal, Jr., P.E.
Senior Vice President
Cahn Engineers, Inc.



This Phase I Inspection Report on Lake Garda Dam has been reviewed by the undersigned Review Board members. In our opinion, the reported findings, conclusions, and recommendations are consistent with the Recommended Guidelines for Safety Inspection of Dams, and with good engineering judgment and practice, and is hereby submitted for approval.

Joseph A. McElroy

JOSEPH A. MCELROY, MEMBER
Foundation & Materials Branch
Engineering Division

Carney M. Terzian

CARNEY M. TERZIAN, MEMBER
Design Branch
Engineering Division

Joseph W. Finegan, Jr.

JOSEPH W. FINEGAN, JR., CHAIRMAN
Chief, Reservoir Control Center
Water Control Branch
Engineering Division

APPROVAL RECOMMENDED:

Joe B. Fryar

JOE B. FRYAR
Chief, Engineering Division

PREFACE

This report is prepared under guidance contained in the Recommended Guidelines for Safety Inspection of Dams, for Phase I Investigations. Copies of these guidelines may be obtained from the Office of Chief of Engineers, Washington, D.C. 20314. The purpose of a Phase I Investigation is to identify expeditiously those dams which may pose hazards to human life or property. The assessment of the general condition of the dam is based upon available data and visual inspection. Detailed investigation, and analyses involving topographic mapping, subsurface investigations, testing, and detailed computational evaluations are beyond the scope of a Phase I Investigation; however, the investigation is intended to identify any need for such studies.

In reviewing this report, it should be realized that the reported condition of the dam is based on observations of field conditions at the time of inspection along with data available to the inspection team. In cases where the reservoir was lowered or drained prior to inspection, such action, while improving the stability and safety of the dam, removes the normal load on the structure and may obscure certain conditions which might otherwise be detectable if inspected under the normal operating environment of the structure.

It is important to note that the condition of a dam depends on numerous and constantly changing internal and external conditions, and is evolutionary in nature. It would be incorrect to assume that the present condition of the dam would necessarily represent the condition of the dam at some point in the future. Only through continued care and inspection can there be any chance that unsafe conditions will be detected.

Phase I inspections are not intended to provide detailed hydrologic and hydraulic analyses. In accordance with the established Guidelines, the Spillway Test Flood is based on the estimated "Probable Maximum Flood" for the region (greatest reasonably possible storm runoff), or fractions thereof. Because of the magnitude and rarity of such a storm event, a finding that a spillway will not pass the test flood should not be interpreted as neccessarily posing a highly inadequate condition. The test flood provides a measure of relative spillway capacity and serves as an aid in determining the need for more detailed hydrologic and hydraulic studies, considering the size of the dam, its general condition and the downstream damage potential.

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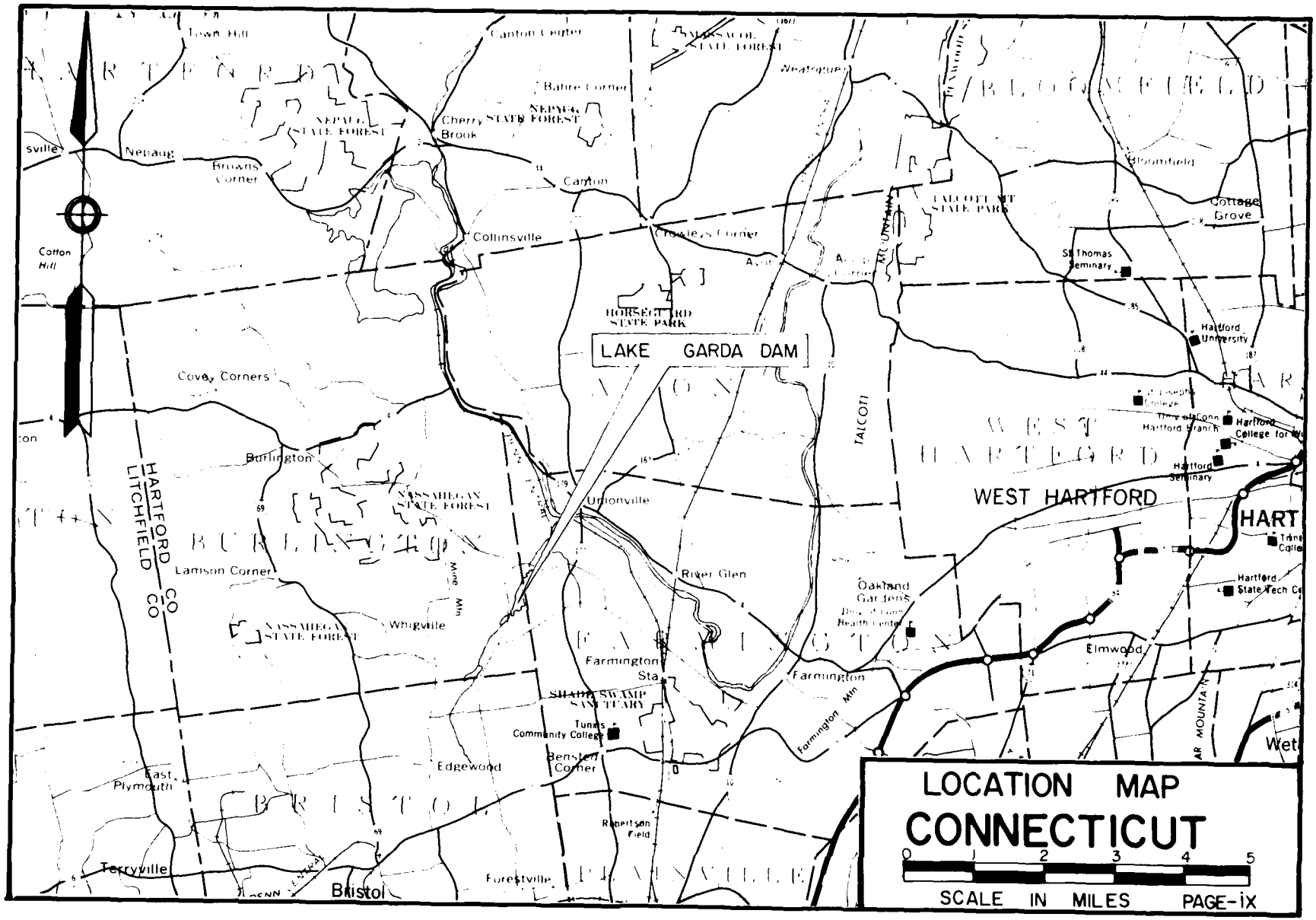
APPENDICES

OVERVIEW PHOTO
(MARCH, 1979)

US ARMY ENGINEER DIV. NEW ENGLAND CORPS OF ENGINEERS WALTHAM, MASS	NATIONAL PROGRAM OF	LAKE GARDA DAM	FARMINGTON	DATE July '79
CAHN ENGINEERS INC. WALLINGFORD, CONN ENGINEER	INSPECTION OF NON-FED DAMS	UNIONVILLE BROOK	CONNECTICUT	CE # 27 595 KB PAGE viii


LAKE GARDA DAM
LOCATION MAP
CONNECTICUT
0 1 2 3 4 5
SCALE IN MILES
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Town Hill
Canton Center
Nepaug State Forest
Cherry Brook
Nepaug
Browns Corner
Canton
Collinsville
Cotton Hill
Covey Corners
Burlington
Hartford Litchfield Co
Nassahegan State Forest
Lamson Corner
Whigville
Unionville
River Glen
Farmington Sta
Talcott Mtn
Tunxis Community College
Edgewood
Bensley Corner
East Plymouth
Terryville
Bristol
Forestville
Wintonbury
Bloomfield
Talcott Mt State Park
Cottage Grove
St Thomas Seminary
Hartford University
Hartford College for Women
Hartford Seminary
WEST HARTFORD
Oakland Gardens
Elmwood
Farmington
Hartford State Tech Co

PHASE I INSPECTION REPORT

LAKE GARDA DAM

SECTION I PROJECT INFORMATION

1.1 GENERAL

a. Authority - Public Law 92-367, August 8, 1972, authorized the Secretary of the Army, through the Corps of Engineers, to initiate a National Program of Dam Inspection throughout the United States. The New England Division of the Corps of Engineers has been assigned the responsibility of supervising the inspection of dams within the New England Region. Cahn Engineers, Inc. has been retained by the New England Division to inspect and report on selected dams in the State of Connecticut. Authorization and notice to proceed were issued to Cahn Engineers, Inc. under a letter of November 28, 1978 from Max B. Scheider, Colonel, Corps of Engineers. Contract No. 33-79-C-0014 has been assigned by the Corps of Engineers for this work.

b. Purpose of Inspection Program - The purposes of the program are to:

1. Perform technical inspection and evaluation of non-federal dams to identify conditions requiring correction in a timely manner by non-federal interests.

2. Encourage and prepare the States to quickly initiate effective dam inspection programs for non-federal dams.

3. To update, verify and complete the National Inventory of Dams.

c. Scope of Inspection Program - The scope of this Phase I inspection report includes:

1. Gathering, reviewing and presenting all available data as can be obtained from the owners, previous owners, the state and other associated parties.

2. A field inspection of the facility detailing the visual condition of the dam, embankments and appurtenant structures.

3. Computations concerning the hydraulics and hydrology of the facility and its relationship to the calculated flood through the existing spillway.

4. An assessment of the condition of the facility and corrective measures required.

It should be noted that this report does not pass judgement on the safety or stability of the dam other than on a visual basis. The inspection is to identify those features of the dam which need corrective action and/or further study.

1.2 DESCRIPTION OF PROJECT

a. Location - The dam is located on Unionville Brook in a surburban area of the Town of Farmington, County of Hartford, State of Connecticut. The dam is shown on the Bristol USGS Quadrangle Map having coordinates latitude N 41° 44.7' and longitude W 72° 54.0'.

b. Description of Dam and Appurtenances - As shown on Sheet B-1, the approximately 300 foot long dam is an earth embankment, the top of which, at elevation 247, is 17 feet above the streambed of Unionville Brook. The crest of the dam, varying in width from approximately 40 to 90 feet, is sparsely covered by grass and has several large trees growing along its downstream edge. The spillway, located at the right end of the dam, is approximately 29.5 feet long and constructed of concrete and stone masonry. The spillway discharge flows in a straight, well confined, sand and gravel channel for approximately 250 feet before it is diverted to the left by large boulders placed in the channel. As the stream turns to the left, it spreads out over a flat wooded area, creating a generally wet condition extending to the toe of the dam. The upstream slope, inclined at approximately 3 horizontal to 1 vertical, is paved with hand placed riprap to approximately two feet above and several feet below the normal pool elevation. The riprap above the waterline is held in place by mortar. The downstream slope of the dam is somewhat irregular and varies in inclination, as the owner periodically adds fill and regrades the slope. Trash was also observed to have been dumped off of the dam onto the downstream slope. There are several large trees growing along the toe, one of which has been uprooted. Four substantial seeps are emanating from the toe of the dam, the largest located at the left end of the dam. A concrete corewall, rising to near the top of the dam, extends the length of the dam. Beneath the corewall is 20 foot deep steel sheet piling. There is a single 24 inch low level outlet through the dam, located near the center of the embankment. The gatehouse, located on the upstream slope is of parged concrete block construction and houses a single manually operated hand wheel floor stand which controls the low level outlet.

c. Size Classification - SMALL - The dam impounds 293 acre-feet of water with the lake level at the top of the dam, which at elevation 247, is 17 feet above the streambed. According to the Recommended Guidelines, a dam with a height of less than 40 feet is classified as small in size.

d. Hazard Classification - HIGH - There are 2 houses downstream of the dam on the north side of Washington Turnpike at approximately the same elevation as the spillway discharge channel. If the dam were to be breached, there is potential for loss of life and extensive property damage at these homes.

e. Ownership - Lake Garda Company, Inc.
Unionville, CT 06085
Mr. Harry Battistoni, (203) 673-9433

In 1930 the dam was originally constructed and owned by Mr. Battistoni, but between 1936 and 1945 it was owned by the Ron-Day Company, which raised the dam, but raised only a portion of the corewall in spite of an order from the State to raise the entire corewall. In 1945 Mr. Battistoni regained ownership of the dam and completed its construction.

f. Operator - Mr. Harry Battistoni

g. Purpose of Dam - Recreational

h. Design and Construction History - The following information is believed to be accurate based on the plans and correspondence available, as well as field observations in which several phases of the dam's construction were evident. The dam was originally constructed in 1930. Plans for the original construction were available, however, the construction varied considerably from what was called for on the plans. In 1936 the dam was raised to its present elevation, however, the corewall was not raised and the construction did not meet with the approval of the State Board for the Supervision of Dams, which was formed in 1939. The Board on several occasions advised the Ron-Day Company, who then owned the dam, to strengthen the dam by raising the corewall. Eventually, in 1945, under State of Connecticut Statutes, the Board ordered the Ron-Day Company to do so. The Ron-Day Company was unable to comply with the order and in 1946, the original and present owner, Harry Battistoni, regained ownership of the dam. Battistoni carried out the raising of the corewall according to the plan entitled "Raised Dam at Lake Garda", dated February 1, 1946 by J. D. Williams, Civil Engineer. The dam remained in this configuration until August 1955 when the dam was overtopped and suffered damages to the downstream spillway training walls, which at that time also served as bridge abutments for a roadway which formerly traversed the dam. In 1957, plans for the repair and widening of the spillway were prepared by Buck and Buck Engineers of Hartford, Connecticut, however, the actual as-built condition of the spillway varies slightly from these plans. The right spillway training wall was entirely reconstructed with stone masonry. Also, a retaining wall was constructed at the right upstream end of the dam in place of the riprap called for on the plans, and the

configuration of the walls at the spillway is slightly different than what was shown on the plans. The 1957 work on the dam also included replacement of the upstream slope riprap along nearly the entire dam. In 1968, the spillway was raised six inches by construction of a one foot wide by six inch high sill atop the then existing spillway crest. Other than the periodic filling and grading on the downstream slope by the owner, the dam has been in its present configuration since 1968.

i. Normal Operational Procedures - The owner normally draws the lake level down every spring to allow property owners to perform maintenance on their waterfronts. The amount of drawdown varies. Other than its yearly operation, the gate is normally left in a closed position.

1.3 PERTINENT DATA

a. Drainage Area - 2.3 square miles of moderately developed rolling terrain.

b. Discharge at Damsite - Discharge is from over the spillway and through a 24 inch low level outlet pipe controlled from the gatehouse on the dam.

1. Outlet Works:	One 24" concrete pipe @ invert elevation 231±
2. Maximum known flood at damsite:	Dam overtopped August, 1955. Depth not known
3. Ungated spillway capacity @ top of dam elevation 247:	463 cfs.
4. Ungated spillway capacity @ test flood elevation 248:	790 cfs
5. Gated spillway capacity @ normal pool elevation:	N/A
6. Gated spillway capacity @ test flood elevation:	N/A
7. Total spillway capacity @ test flood elevation 248:	790 cfs
8. Total project discharge @ test flood elevation 248:	2000 cfs.

c. Elevations - (Feet Above Mean Sea Level)

1. Streambed at centerline of dam:	230±
2. Maximum tailwater:	N/A
3. Upstream portal invert diversion tunnel:	N/A
4. Recreation pool:	244±
5. Full flood control pool:	N/A
6. Spillway crest:	244
7. Design surcharge (original design):	N/A
8. Top of dam:	247± (lowest point on dam)
9. Test flood design surcharge:	248±

d. Reservoir

1. Length of maximum pool:	3600+ ft.
2. Length of recreation pool:	3600± ft.
3. Length of flood control pool:	N/A

e. Storage

1. Recreation pool:	173± acre-ft.
2. Flood control pool:	N/A
3. Spillway crest pool:	173± acre-ft.
4. Top of dam:	293± acre-ft.
5. Test flood pool:	350+ acre-ft.

f. Reservoir Surface

1. Recreation pool:	40± acres
2. Flood control pool:	N/A
3. Spillway crest:	40± acres
4. Test flood pool:	N/A
5. Top of dam:	52± acres

g. Dam

1. Type:	Earthen embankment with concrete core-wall.
2. Length:	300± ft.
3. Height:	17± ft.
4. Top width:	40 to 90 ft.
5. Side slopes:	3H to 1V (Upstream) Irregular (Downstream)
6. Zoning:	N/A
7. Impervious Core:	Concrete corewall
8. Cutoff:	Steel sheet piling beneath corewall.
9. Grout curtain:	N/A
10. Other:	N/A

h. Diversion and Regulating Tunnel N/A

i. Spillway

1. Type	Stone masonry spillway with broad crested concrete weir of trapezoidal cross-section.
2. Length of weir:	29.5 ft.
3. Crest elevation:	244
4. Gates:	N/A
5. Upstream Channel:	Shallow rocky lake bottom
6. Downstream Channel:	Paved with concrete for 40' then natural gravel streambed.
7. General:	N/A

j. Regulating Outlet - The single low level outlet is a 24" concrete pipe.

1. Invert:	231±

2. Size:	24"diameter
3. Description:	Concrete pipe (at exit from downstream slope).
4. Control Mechanism:	Hand operated floor stand
5. Other:	Gate on upstream slope of dam.

SECTION 2: ENGINEERING DATA

2.1 DESIGN

a. Available Data - The available plans consist of 1) a drawing by J. D. Williams, Civil Engineer, for the 1946 repairs and completion of the dam which had been raised in 1936, but not approved by the State Board for the Supervision of Dams and 2) a drawing by Buck and Buck Engineers of Hartford, Connecticut for the 1957 widening of the spillway. 1974 plans for the Lake Garda Interceptor and Washington Circle Interceptor Sanitary sewers, both of which pass through the dam, were obtained from the Farmington Town Engineer's Office along with a special detail showing the sewer pipe passing through the corewall of the dam (Appendix B-21). Other selected data and correspondence relating to the different stages of construction of the dam is included in Appendix B.

b. Design Features - The drawings, data and correspondence are generally consistent with the design features stated in Section 1.2, with the exception of the 1957 widening of the spillway, which was not constructed according to plan.

c. Design Data - There were no engineering values, assumptions, test results or calculations available for any of the construction phases of the dam, other than a letter dated May 10, 1956 written by H. W. Buck prior to the widening of the spillway, stating that an increase of approximately 50% in the length of the spillway would allow the spillway to pass the 100 year flood (B-14).

2.2 CONSTRUCTION

a. Available Data - Although no as-built drawings are known to exist, several construction inspection reports relating to the 1946, 1957 and 1968 construction and modifications of the dam were available and are included in Appendix B.

b. Construction Considerations - No information was available.

2.3 OPERATIONS

Lake level readings are not taken. The dam was overtopped during the flood of August, 1955.

2.4 EVALUATION

a. Availability - Existing data was provided by the Water Resources Unit of the State of Connecticut Department of Environmental Protection, the Farmington Town Engineer's Office, and the owner. The owner made the facility available for visual inspection.

b. Adequacy - The limited amount of detailed engineering data available was generally inadequate to perform an in-depth assessment of the dam, therefore, the final assessment of this dam must be based primarily on visual inspection, performance history, hydraulic computations of spillway capacity and approximate hydrologic judgements.

c. Validity - A comparison of record data and visual observations indicates differences in the height of the dam and the configuration of the spillway. While the top of the dam is about 2 feet higher than the top of the corewall near the left end, near the right end adjacent to the spillway the top of the dam and the corewall are at close to the same elevation. The actual configuration of the spillway differs from that shown on the existing plans (See Sheet B-1).

SECTION 3: VISUAL INSPECTION

3.1 FINDINGS

a. General - The general condition of the dam is poor. Inspection revealed some areas requiring monitoring or maintenance. At the time of our inspection there were approximately 2 inches of water flowing over the spillway crest.

b. Dam

Crest - The crest of the dam, which varies in width from approximately 40 feet at the right end of the embankment to approximately 90 feet at its left end, is sparsely vegetated with grass and exhibits some erosion. Several large trees are growing along the downstream edge of the crest for the length of the dam, and a clump of small sumac trees is growing on the crest just to the left of the spillway. There appears to be much trespassing on the crest as well as on the downstream slope. The condition of the crest is poor adjacent to the left spillway wall exposing a bouldery fill, visible from downstream (Photo 6).

Upstream Slope - The upstream slope of the dam is inclined at 3 horizontal to 1 vertical and is partially protected by riprap, which is cemented above the waterline. The riprap extends to only about three feet below the crest and is missing for a length of approximately 40 feet near the left end of the dam (Photo 3). Below the waterline, riprap extends for an undetermined distance, however, it is not held in place by mortar. The top two feet of the slope is covered with grass and/or small bushes. The upstream slope is slightly eroded in areas where vegetation is absent.

Downstream Slope - The downstream slope is very irregular as a result of fill placed at different times on the slope (Photo 4). In some areas at the toe of the slope there is miscellaneous fill consisting of tree branches, lumber, trash cans, tires, etc. There are trees and brush growing on the slope for most of its length, and one rather large tree at the toe has been uprooted. There are four observable areas of seepage along the toe, the largest of which, located at the left end of the dam, yields a flow of several gallons per minute. The seepage is rust colored, which may indicate flow from the reservoir, however it does not appear to be transporting any soil. Due to an obstruction which diverts the spillway discharge channel to the left, parallel to the toe of the dam, a generally wet condition exists downstream of the dam and extends to the toe of the downstream slope.

Spillway - The spillway is a concrete broad-crested weir of trapezoidal cross-section with a right training wall of stone masonry construction and a left training wall of concrete and stone masonry (Photo 1). The discharge channel is paved to the downstream end of the training walls. The spillway and walls were originally entirely of concrete, and a bridge traversed the spillway channel. After the flood of August 1955, during which the bridge washed out and the right training wall partially collapsed at the bridge abutments, the spillway was widened and the right training wall entirely reconstructed. This post-1955 construction is of stone masonry and is in good condition (Photo 5). The concrete of the left training wall, dating from 1936, is heavily spalled and badly deteriorated (Photo 6). An approximately 10" length of reinforcing is exposed in one area on the wall and several weep holes were observed to have been drilled in the training wall. There is some indication of movement of the wall as viewed from the downstream end of the wall where the concrete cap has fallen off. The lowest portion of the wall, presumably dating from the original construction, is in fairly good condition with only a minor amount of cracking and one small seep at its base.

At the time of our inspection the right training wall was partially undermined and deteriorated at the bottom, however, upon a subsequent visit to the dam, this condition had been repaired with concrete. Some seepage was also noted to be emanating from the base of the wall, however, the exit point was covered by the recent repairs to the wall. There is some erosion due to trespassing around the downstream end of the wall.

The concrete spillway is one foot wide at its crest and 29.5 feet long. Although difficult to observe under overflowing conditions, the concrete appeared to be in good condition. There are two 15" pipes through the center of the spillway, which previously may have served as low level outlets, but which are now plugged. Two iron reinforcing bars are sticking up through the 6 inch high sill of concrete, which was added in 1968.

c. Appurtenant Structures - There is a small concrete block gatehouse on the upstream slope near the middle of the embankment. The concrete blocks have been parged with mortar which is extensively cracked along the joints between the blocks. A single hand-operated floor stand in the gatehouse is operable and controls the valve for the 24" low level outlet pipe (Photo 8). Approximately four feet of the top of the pipe at its downstream end is broken away. A slight flow as well as some siltation was observed in the pipe indicating that perhaps the valve is not water-tight or that there is some seepage into the pipe downstream of the valve within the dam.

In 1974, the Lake Garda Interceptor and the Washington Circle Interceptor Sewers were constructed. At the left and right ends of the dam, the sewer pipes pass through the corewall of the dam. If, after installation, the core was not properly sealed around the pipe, seepage could result. It is possible that the flow of several gallons per minute observed at the toe of the dam at the left end is a result of seepage through the core at the location of the pipe. At the right end of the dam, the seepage observed to be emanating from the base of the right spillway training wall could be similarly caused by the sewer through the corewall.

d. Reservoir Area - There were no indications of slope instability or sedimentation problems. It is possible that several cottages around the lake could be damaged by waters in the lake rising to the elevation of the top of the dam.

e. Downstream Channel - From the paved spillway discharge channel which extends to the downstream end of the spillway training walls, flow is carried in a well confined, gravel bottom, natural stream channel for approximately 250 feet before being diverted to a flat area at the toe of the dam by boulders placed in the stream channel. The owner of the dam also owns building lots downstream of the dam, and is diverting the downstream channel to the left in order to fill and grade a lot to the right of the channel. Due to this diversion, a generally wet, swamp-like condition exists between the toe of the dam and Washington Turnpike, approximately 300 feet downstream of the dam. This generally wet condition has possibly contributed to the uprooting of the tree at the toe of the dam.

3.2 EVALUATION

Based upon the visual inspection, it was possible to assess the dam as being generally in poor condition. The following features which could influence the future condition and/or stability of the dam were identified.

1. The condition of the badly spalled and deteriorated concrete of the left spillway training wall will become worse, eventually compromising the stability of the wall.

2. It is possible that seepage through the dam could increase in volume and sediment content, potentially threatening the stability of the embankment.

3. Sparse ground cover on the crest and the lack of riprap in an area on the upstream slope increase the potential for loss of material due to surface erosion.

4. The roots of trees growing on the crest and downstream slope of the dam could conceivably provide paths for seepage through the dam, however, the concrete corewall lessens this possibility somewhat.

5. The generally wet condition at the toe of the dam could saturate areas resulting in sloughing at the toe, as well as increasing the possibility of trees at the toe being uprooted.

6. The lack of a well defined channel downstream of the dam presents the possibility of erosion along the downstream toe during high discharge conditions.

7. Improper or indiscriminate placement of fill on the downstream slope of the dam could give rise to slope stability problems.

8. Debris may collect against the reinforcing bars protruding up from the spillway crest, causing partial blockage of the spillway.

9. The recent repairs to the right spillway training wall could suffer damages, such as cracking and heaving, caused by freezing and thawing of seepage water trapped in the wall.

SECTION 4: OPERATIONAL PROCEDURES

4.1 REGULATING PROCEDURES

Lake level readings are not taken. The low level outlet is opened once a year in the spring to lower the lake level and thereby permit property owners adjacent to the lake to perform any required maintenance on their waterfront property.

4.2 MAINTENANCE OF DAM

Minimal maintenance of the dam is performed by the owner on an as-needed basis. Repairs to the deteriorated concrete near the base of the right spillway training wall were performed in the spring of 1979.

4.3 MAINTENANCE OF OPERATING FACILITIES

The owner performs maintenance as needed to keep the low level outlet floor stand and gate in an operable condition.

4.4 DESCRIPTION OF ANY FORMAL WARNING SYSTEM IN EFFECT

No formal warning system is in effect.

4.5 EVALUATION

The operation and maintenance procedures are minimal. A complete formal program of operation and maintenance procedures should be implemented, including documentation to provide complete records for future reference. Also, a formal warning system should be developed and implemented within the time-frame indicated in Section 7.1c. Remedial operation and maintenance recommendations are presented in Section 7.

SECTION 5: HYDRAULIC/HYDROLOGIC

5.1 EVALUATION OF FEATURES

a. General - The Lake Garda watershed area is classified as rolling terrain, and includes Monce Pond, immediately upstream of Lake Garda.

b. Design Data - The available correspondence contains references to the 100 year storm and the ability of the spillway to pass such a storm (B-14, B-20). No other hydraulic/hydrologic design data was available.

c. Experience Data - Correspondence indicates a "hurricane flood" of 3+ feet due to the September 1938 hurricane; it was not stated whether the figure of 3+ feet was over the spillway crest or the top of the dam.

The dam was overtopped during the August 1955 storm; it is not known by how much the dam was overtopped, however a roadway bridge spanning the spillway training walls was washed out. No damage to the dam structure aside from the bridge abutments occurred, however. (B-14, B-16)

d. Visual Observations - There is no bridge spanning the spillway now, however, it is possible that the 29.5 foot spillway opening could be blocked by large floating debris in the event of a major flood.

The diversion of the spillway channel downstream of the dam could be easily washed out by flow from the spillway in a large storm thus allowing flow to go directly across the roadway to a downstream residential structure.

e. Test Flood Analysis - The test flood for this high hazard, small size dam is equivalent to one-half the Probable Maximum Flood (PMF). Based upon "Preliminary Guidance for Estimating Maximum Probable Discharges", dated March, 1978, peak inflow to the lake is 2375 cfs (Appendix D-3); peak outflow is 2000 cfs with the dam overtopped 1+ feet (Appendix D-8). Based upon our hydraulics computations, the spillway capacity is 463 cfs, which is approximately 20% of the routed test flood outflow at the top of dam.

f. Dam Failure Analysis - Utilizing the April, 1978, "Rule of Thumb Guidance for Estimating Downstream Dam Failure Hydrographs", the peak failure outflow from the dam breaching would be 14,100 cfs. A breach of the dam would result in a rapid rise in the water level of 5.5 feet, corresponding to an increase in the water level from a depth on the order of 2 feet just before the breach to a depth on the order of 7.5 feet just after the breach. This rapid increase in the stage confined to the path of the stream channel would affect the two residential structures in the immediate impact area. A breach of the dam near the spillway would result in a 7.5 foot flow of water proceeding directly across the street to the 2 houses in the initial impact area, rather than being confined to the downstream channel.

SECTION 6: STRUCTURAL STABILITY

6.1 EVALUATION OF STRUCTURAL STABILITY

a. Visual Observations - The visual observations do not indicate any immediate stability problems. There is some minor sloughing in the fill added by the owner on the upstream slope. Sloughing of fill on the downstream slope is more widespread due to the loose condition of much of the fill.

Repairs recently performed to the deteriorated right spillway training wall were needed to prevent further deterioration of the wall, and a subsequent stability problem. Any other spalled or badly cracked concrete should likewise be repaired to preclude any stability problems with either of the training walls.

b. Design and Construction Data - The limited amount of design and construction data available does not contain information that would indicate any stability problems. Sewer pipes, which pass through the concrete core of the dam, were built in about 1974. There are no indications of the sewer pipes having caused any problems for the dam; however, the sewer pipes could, in the future, be a source of leaks through the core or of leaks into the sewer pipe if settlements cause pipe movements. It is possible that some of the seepage at the left toe of the dam could be a result of seepage through the corewall along the sewer pipe.

c. Operating Records - There are no operating records which indicate past structural stability problems. The dam was overtopped by the August, 1955 flood causing the bridge spanning the two spillway walls to be washed out, and the bridge abutments, which were part of the training walls, to be damaged.

d. Post-Construction Changes - The post construction changes to the dam include raising of the corewall 2 feet in 1946, widening of the spillway between 1957 and 1960, raising of the spillway 6 inches in 1968, and the placing of miscellaneous fill on the crest and downstream slope over the years. The heterogeneous fill placed on the downstream slope appears loose, however, its affect on the stability of the dam depends on the relative permeabilities of the dam and the fill, and hence is not known.

e. Seismic Stability - The dam is located in Seismic Zone 1 and in accordance with the Recommended Guidelines, need not be evaluated for seismic stability.

SECTION 7: ASSESSMENT, RECOMMENDATIONS AND REMEDIAL MEASURES

7.1 DAM ASSESSMENT

a. Condition - Based upon the visual inspection of the site and its past performance, the dam appears to be in poor condition. Some evidence of deterioration and possible instability was observed in the left spillway training wall. The embankment is generally in fair condition with several areas of concern, such as the lack of adequate upstream slope protection, the sparse vegetation on the crest, the trees on the crest and downstream slope, the substantial seepage emanating from the toe of the dam, and the wet condition at the toe due to the diversion of the natural discharge channel.

Based upon "Preliminary Guidance for Estimating Maximum Probable Discharges" dated March, 1978, peak inflow to the reservoir is 2,375 cubic feet per second; peak outflow is 2,000 cubic feet per second with the dam overtopped one foot. Based upon our hydraulics computations, the spillway capacity is 463 cubic feet per second, which is equivalent to approximately 20% of the routed test flood outflow.

b. Adequacy of Information - The information available is such that an assessment of the condition and stability of the dam must be based solely on visual inspection, past performance of the dam, and sound engineering judgement.

c. Urgency - It is recommended that the measures presented in Section 7.2 and 7.3 be implemented with one year of the owner's receipt of this report.

d. Need for Additional Information - There is a need for more information as recommended in Section 7.2.

7.2 RECOMMENDATIONS

It is recommended that further studies by undertaken by a registered professional engineer qualified in dam design and inspection pertaining to the following:

1. A more detailed hydraulic/hydrologic analysis to determine the adequacy of the project discharge. Recommendations should be made by the engineer and implemented by the owner to increase the project discharge capacity based upon the refined test flood figures.

The engineer should develop plans and specifications to be implemented by the owner for the construction of a properly sized and paved protected spillway discharge channel which will confine flow from the spillway, rather than allowing it to flow along the toe of the dam. The low level outlet should be extended through a pipe or paved channel to intercept the revised discharge channel.

2. Spalled and deteriorated areas of the left spillway training wall should be repaired. Installation of weepholes through the wall may assist in reducing the rate of future deterioration of the wall. Installation of weepholes in the recently repaired right training wall could prevent damage to the repairs such as cracking and heaving due to freeze-thaw conditions. The engineer should also analyze the indications of movement of the left wall and, if deemed necessary, prescribe appropriate corrective measures.

3. Trees growing on the dam and within 5 feet of the toe should be removed and the resultant voids filled and compacted. The downstream slope should be cleaned of debris, graded and seeded. The engineer should analyze the fill material on the downstream slope and, if deemed necessary, direct its removal. Further dumping of material on the downstream slope should be avoided.

7.3 REMEDIAL MEASURES

a. Operation and Maintenance Procedures - The following measures should be undertaken within the time frame indicated in Section 7.1c, and continued on a regular basis.

1. Round-the-clock surveillance should be provided by the owner during periods of unusually heavy precipitation. The owner should develop a formal warning system with local officials for alerting downstream residents in case of an emergency.

2. A formal program of operation and maintenance procedures should be instituted and fully documented to provide accurate records for future reference.

3. A program of inspection by a registered professional engineer qualified in dam inspection should be instituted on an annual basis. The inspections should be technical in nature and should include the evaluation and operation of the low level outlet works.

4. Riprap should be replaced on the upstream slope in the areas where it is absent, and grass should be planted on the crest of the dam.

5. The seepage at the toe of the dam should be regularly monitored for increased flow or turbidity. A written and photographic record of the monitoring should be kept for future reference and comparison.

6. The low level outlet pipe should be repaired and the reinforcing bars on the spillway should be cut off at the spillway crest.

7.4 ALTERNATIVES

This study has identified no practical alternatives to the above recommendations.

APPENDIX A

INSPECTION CHECKLIST

VISUAL INSPECTION CHECK LIST
PARTY ORGANIZATION

PROJECT LAKE GARDA DAM DATE: 4/4/79

TIME: 9:00 AM

WEATHER: OVERCAST 50°

W.S. ELEV. 244.2± U.S. _____ DN.S

PARTY:	INITIALS:	DISCIPLINE:
1. CALVIN GOLDSMITH	CG	CAHN ENGINEERS, INC.
2. THEODORE STEVENS	TS	CAHN ENGINEERS, INC.
3. GONZALO CASTRO	GC	GEOTECHNICAL ENGINEERS, INC.
4. HARRY BATTISTONI	HB	LAKE GARDA CO. INC.
5. PETER HEYNEN	PH	CAHN ENGINEERS, INC.
6.		

PROJECT FEATURE	INSPECTED BY	REMARKS
1. EARTH DAM EMBANKMENT	CG, TS, GC, PH	
2. GATEHOUSE	CG, TS, GC, PH	
3. 24" CONCRETE BLOWOFF PIPE	CG, TS, GC, PH	
4. SPILLWAY	CG, TS GC, PH	
5.		
6.		
7.		
8.		
9.		
10.		
11.		
12.		

PERIODIC INSPECTION CHECK LIST

PROJECT LAKE GARDA DAM DATE 4/4/79

PROJECT FEATURE EARTH DAM EMBANKMENT BY CG, TS, GC, PH

AREA EVALUATED		CONDITION
DAM EMBANKMENT		
Crest Elevation		247±
Current Pool Elevation		244.2±
Maximum Impoundment to Date		OVERTOPPED AUGUST 1955
Surface Cracks		NONE OBSERVED
Pavement Condition		N/A
Movement or Settlement of Crest		NONE OBSERVED
Lateral Movement		TOO IRREGULAR TO JUDGE
Vertical Alignment		
Horizontal Alignment		
Condition at Abutment and at Concrete Structures		POOR - SLIGHT MOVEMENT OF LEFT SPILLWAY TRAINING WALL
Indications of Movement of Structural Items on Slopes		N/A
Trespassing on Slopes		DUMPING OF BRUSH, GARBAGE ON D/S SLOPE
Sloughing or Erosion of Slopes or Abutments		MINOR EROSION ON U/S SLOPE EROSION AROUND TRAINING WALLS
Rock Slope Protection-Riprap Failures		RIRRAP ABSENT FROM AREAS ON U/S SLOPE
Unusual Movement or Cracking at or Near Toes		NONE OBSERVED
Unusual Embankment or Downstream Seepage		FOUR SEEPS AT DOWNSTREAM TOE
Piping or Boils		NONE OBSERVED
Foundation Drainage Features		N/A
Toe Drains		N/A
Instrumentation System		N/A

PERIODIC INSPECTION CHECK LIST

PROJECT Lake Garda Dam DATE 4/4/79

PROJECT FEATURE Gatehouse BY CG, TS, GC, PH

AREA EVALUATED		CONDITION
OUTLET WORKS-INTAKE CHANNEL AND INTAKE STRUCTURE		
a) Approach Channel		NO CHANNEL VISIBLE
Slope Conditions		
Bottom Conditions		
Rock Slides or Falls		
Log Boom		
Debris		
Condition of Concrete Lining		
Drains or Weep Holes		
b) Intake Structure		CINDER BLOCK GATEHOUSE WITH MORTAR RESURFACING
Condition of Concrete		MORTAR CRACKED ALONG JOINTS BETWEEN BLOCKS
Stop Logs and Slots		SINGLE HAND WHEEL FLOOR STAND DOOR TO GATEHOUSE ON UPSTREAM SIDE AND ON UPSTREAM SLOPE — PROBABLY INACCESSABLE AT HIGH WATER LEVELS

PERIODIC INSPECTION CHECK LIST

PROJECT LAKE GARDA DAM DATE 4/4/79

PROJECT FEATURE 24" CONCRETE BLOWOFF PIPE BY CG, TS, GC, PH

AREA EVALUATED	CONDITION
OUTLET WORKS-TRANSITION AND CONDUIT	
General Condition of Concrete	FAIR - COULD NOT OBSERVE PIPE EXCEPT FROM OUTLET AT DOWNSTREAM TOE OF DAM WHERE TOP OF PIPE IS BROKEN AWAY FOR A LENGTH OF 4'I AT DOWNSTREAM END OF PIPE. SLIGHTLY SILTED IN, HOWEVER IS FLUSHED YEARLY
Rust or Staining on Concrete	
Spalling	
Erosion or Cavitation	
Cracking	
Alignment of Monoliths	
Alignment of Joints	
Numbering of Monoliths	

PERIODIC INSPECTION CHECK LIST

PROJECT LAKE GARDA DAM DATE 4/4/79

PROJECT FEATURE SPILLWAY BY CG, TS, GC, PH

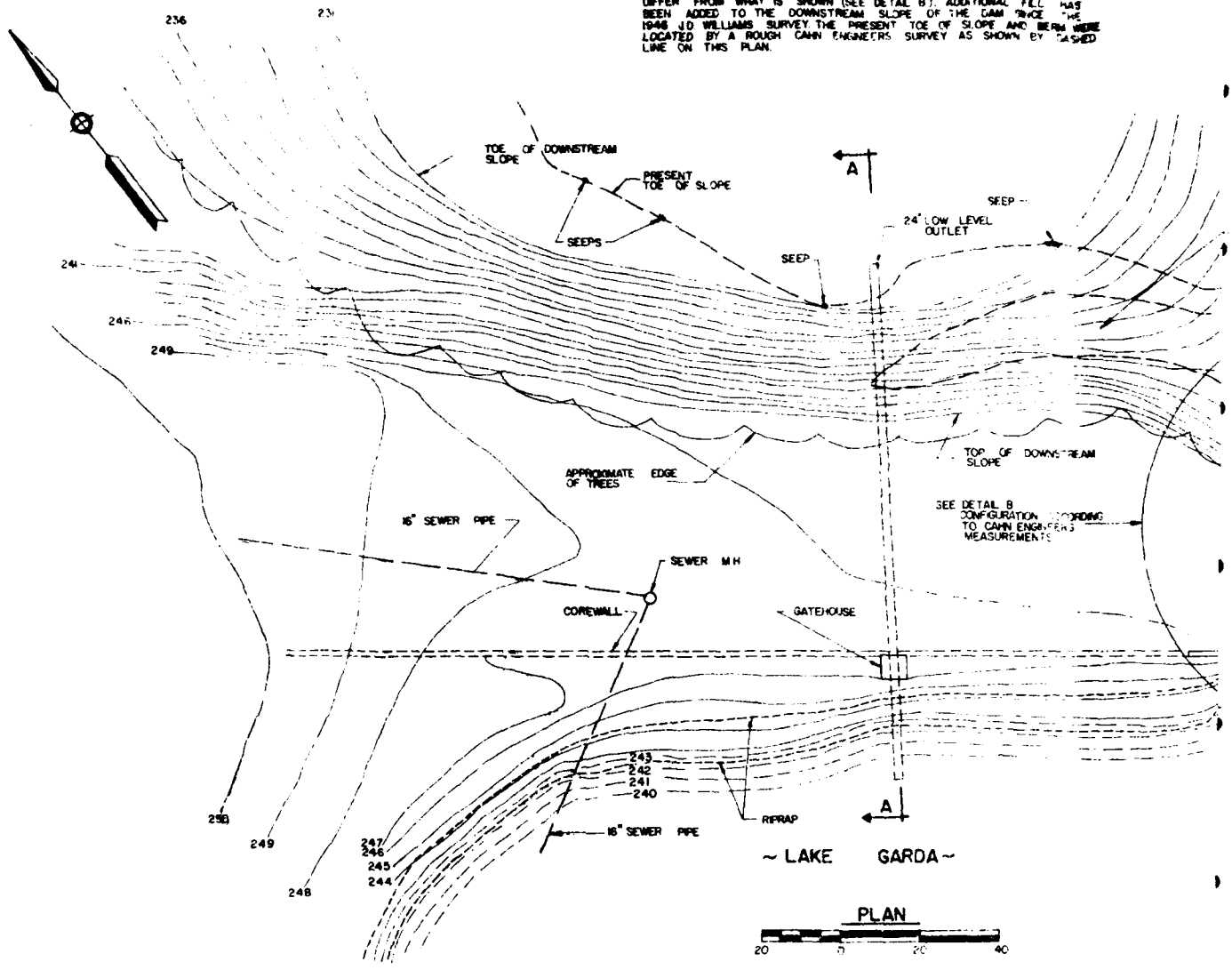
AREA EVALUATED		CONDITION
OUTLET WORKS-SPILLWAY WEIR, APPROACH AND DISCHARGE CHANNELS		
a) Approach Channel		SHALLOW LAKE BOTTOM WITH CONC. FOOTING EXTENDING FROM SPILLWAY
General Condition		
Loose Rock Overhanging Channel		N/A
Trees Overhanging Channel		N/A
Floor of Approach Channel		ROCKY - TO DISCOURAGE SWIMMERS
b) Weir and Training Walls		CONCRETE WEIR, CONCRETE AND STONE MASONRY TRAINING WALLS
General Condition of Concrete		POOR
Rust or Staining		NONE OBSERVED
Spalling		YES - EXTENSIVE ON LEFT TRAINING WALL
Any Visible Reinforcing		YES - 10"-12" LONG ON LEFT TRAINING WALL
Any Seepage of Efflorescence		SLIGHT SEEPAGE THROUGH LEFT WALL
Drain Holes		WEEP HOLES 0.7'-1.3' DEEP IN LEFT TRAINING WALL
c) Discharge Channel		
General Condition		GOOD OTHER THAN OBSTRUCTION APPROX. 250' DS OF SPILLWAY
Loose Rock Overhanging Channel		NONE OBSERVED
Trees Overhanging Channel		NONE OF SIGNIFICANCE
Floor of Channel		GRAVELLY NATURAL STREAMBED
~~Other~~ Obstructions		250' DS OF SPILLWAY, BOULDERS PLACED ACROSS CHANNEL TO DIVERT FLOW TO LEFT - COLLECTING DEBRIS

APPENDIX B

ENGINEERING DATA AND CORRESPONDENCE

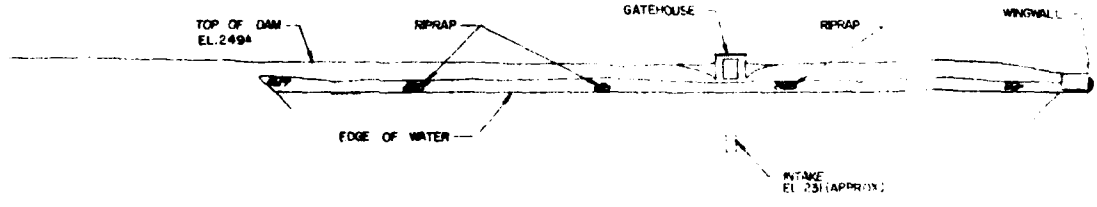
NOTE

THIS DAM CONFIGURATION TAKEN FROM PLAN ENTITLED "RAISED DAM AT LAKE GARDA DATED FEB. 1, 1946 BY J.D. WILLIAMS CIVIL ENGINEER. THE AS-BUILT CONFIGURATION OF THE SPILLWAY AND SPILLWAY CHANNEL DIFFER FROM WHAT IS SHOWN (SEE DETAIL B). ADDITIONAL FILL HAS BEEN ADDED TO THE DOWNSTREAM SLOPE OF THE DAM SINCE THE 1946 J.D. WILLIAMS SURVEY. THE PRESENT TOE OF SLOPE AND BERM WERE LOCATED BY A ROUGH CAHN ENGINEERS SURVEY AS SHOWN BY DASHED LINE ON THIS PLAN.



PLAN

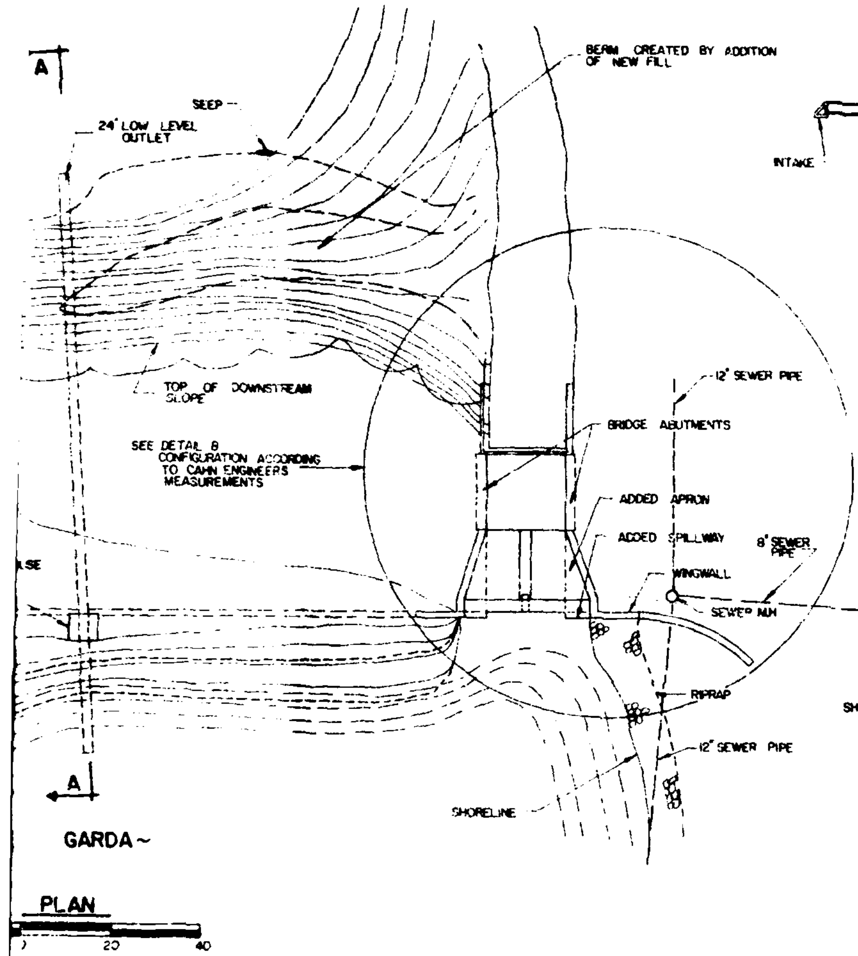
20 0 20 40

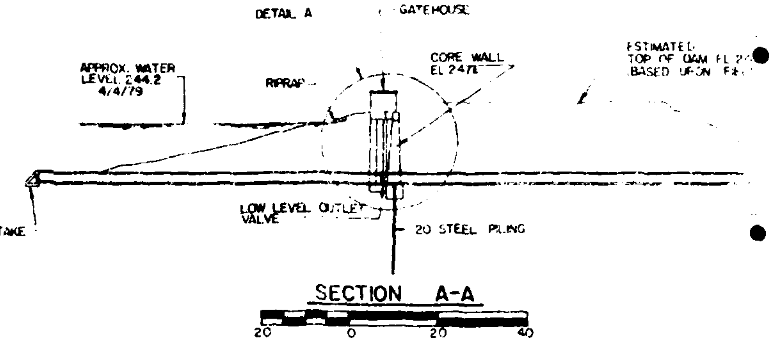


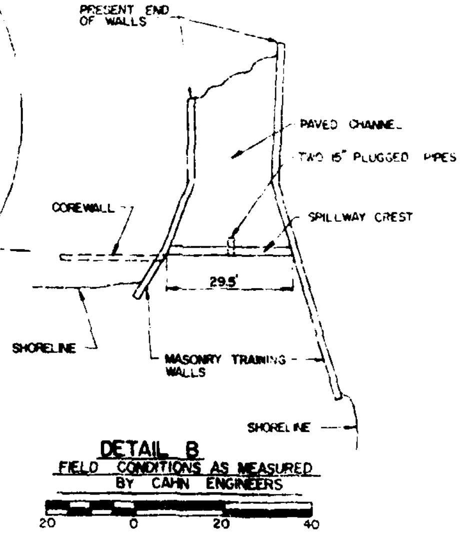
ELEVATION UPSTREAM

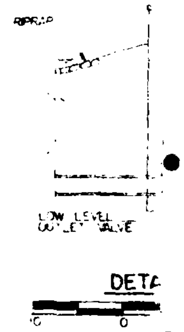
20 0 20 40

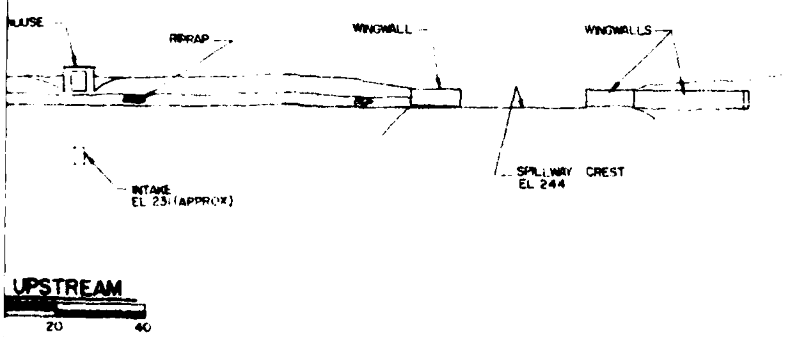
FROM PLAN ENTITLED "RAISED DAM ... 1946 BY J.D. WILLIAMS CIVIL ENGINEER.
... THE SPILLWAY AND SPILLWAY CHANNEL
(SEE DETAIL B). ADDITIONAL FILL HAS
...EAM SLOPE OF THE DAM SINCE THE
PRESENT TOE OF SLOPE AND BERM WERE
...GINEERS SURVEY AS SHOWN BY DASHED









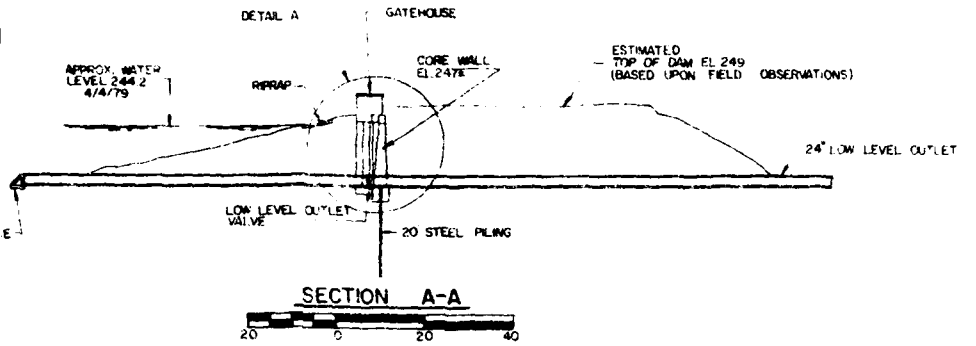


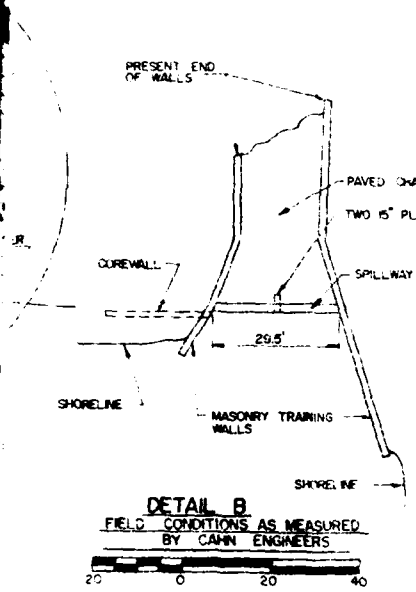
NOTES

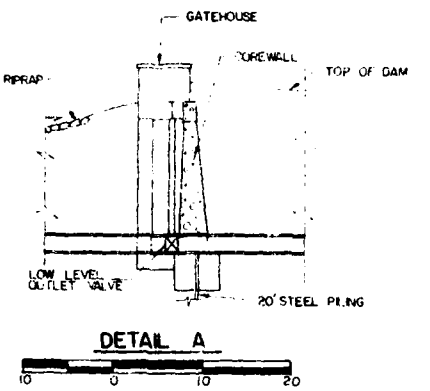
1. THIS PLAN WAS COMPILED FROM ... AT LAKE GARDA DATED FEB 1, 19... THE SPILLWAY IS SHOWN ACCORD... WIDENING DATED JUNE 25, 1957 ... DETAIL B ACCORDING TO CAHN ENGINE... NOT ALL TOPOGRAPHIC AND/OR S... IDENTIFIED
2. ALL ELEVATIONS SHOWN ARE MEAN ... DATUM USED IN 1946 TOPOGRAPH... J.D. WILLIAMS.

A WATER SURFACE ELEVATION OF ... QUADRANGLE MAP WAS ASSUMED ... OF THE SPILLWAY CREST. ALL ... TO THE SPILLWAY CREST ELEVAT... WILLIAMS DATUM ELEV...

CAHN ENGINEERS INC. WALLINGFORD, CONN. ENGINEERS	U.S.
NATIONAL PROGRAM OF ...	
PLAN ELEVATIO...	
LAKE	
UNIONVILLE BROOK	
DRAWN BY	CHECKED BY / APPROV...







NOTES

1. THIS PLAN WAS COMPILED FROM A DRAWING ENTITLED "RAISED DAM AT LAKE GARDA" DATED FEB. 1, 1946 BY J.D. WILLIAMS, CIVIL ENGINEER. THE SPILLWAY IS SHOWN ACCORDING TO A PLAN ENTITLED "SPILLWAY WIDENING" DATED JUNE 25, 1957 BY BUCK AND BUCK ENGINEERS AND DETAIL B ACCORDING TO CAHN ENGINEERS FIELD SURVEY OF APRIL 7, 1979. NOT ALL TOPOGRAPHIC AND/OR STRUCTURAL FEATURES ARE NECESSARILY IDENTIFIED.

2. ALL ELEVATIONS SHOWN ARE MEAN SEA LEVEL, CONVERTED FROM A DATUM USED IN 1946 TOPOGRAPHIC SURVEY OF THE DAM BY J.D. WILLIAMS.

   A WATER SURFACE ELEVATION OF 244 AS SHOWN ON THE USGS BRISTOL QUADRANGLE MAP WAS ASSUMED TO BE THE MEAN SEA LEVEL ELEVATION OF THE SPILLWAY CREST. ALL OTHER ELEVATIONS SHOWN ARE RELATIVE TO THE SPILLWAY CREST ELEVATION OF 244 MSL (SOR WILLIAMS DATUM) (WILLIAMS DATUM ELEVATION 264' = MSL ELEVATION)

CAHN ENGINEERS INC WALLINGFORD, CONNECTICUT ENGINEER	U.S. ARMY ENGINEER DIV NEW ENGLAND CORPS OF ENGINEERS WALTHAM, MASS.

NATIONAL PROGRAM OF INSPECTION OF NON-FED DAMS

PLAN ELEVATION SECTION & DETAILS

LAKE GARDA DAM

UNIONVILLE BROOK — FARMINGTON, CONNECTICUT

DRAWN BY	CHECKED BY	APPROVED BY	SCALE AS NOTED	
AJS	LRB	PMH	DATE JULY 1979	SHEET 8 of 11

LAKE GARDA DAM

EXISTING PLANS

"Raised Dam at Lake Garda"
J. D. Williams, Civil Engineer
Feb. 1, 1946

"Spillway Widening - Lake Garda"
Plan and Details
Buck and Buck Engineers
Hartford, Conn.
June 25, 1957

Town of Farmington
"Sanitary Sewer - Lake Garda Interceptor"
Office of Town Engineer
Farmington, Conn.
Sept. 18, 1974

Town of Farmington
"Sanitary Sewer - Washington Circle Interceptor"
Office of Town Engineer
Farmington, Conn.
Sept. 18, 1974

SUMMARY OF DATA AND CORRESPONDENCE

DATE	TO	FROM	SUBJECT	PAGE
July 2, 1957	Water Resources Commission	Harry Battistoni	Application for construction permit	B-15
July 12, 1957	V. B. Clarke	Harry Battistoni	Correspondence concerning alterations	B-16
June 24, 1960	H. W. Buck	Merwin E. Hupfer	Inspection report	B-18
June 17, 1963	Files	Water Resources Commission	Inventory Data	B-19
July 1, 1968	Files	W. H. O'Brian	Raising of spillway	B-20
August 27, 1974	Files	Farmington Town Engineer	Corewall - Lake Garda interceptor	B-21
Oct. 2, 1975	Victor F. Galgowski, Water Resources Commission	S. E. Minor & Co., Inc.	Dam Inspection Report	B-22

COPY

Lake Garda, Unionville, Connecticut

Lake Garda - 13 ft. deep at dam
Area - 40 acres, 1 mile long
Spillway 18 feet long, 4 ft. wall
Corewall 200 ft. west, 10 ft. east
Spillway raised 4 ft. in 1929

1935-35 Corewall 10 ft. above pond
Base of dam - 6' x 4' thick
Hurricane flood 3 ft. +
24 inch valve in center
Watershed 2.1 square miles
Spillway required (3 x 29)
(According to tables by A. B. Hill) (4 x 19) 249 cfs
(5 x 15)

Spillway depth 3' = 17.3033 cfs/ft. of length
5' x 13' = 37.2304 x 13 = 484 cfs = 242 cfs/sq mi.
5' x 18' = 18/13 x 242 = 335 cfs/sq. mi.

Plans from State Library
Proposed Dam - Rose Brook - Farmington
for Harry J. Battistoni
January 28, 1920 J. D. William, Eng.

Top of Dam Elevation 508
Spillway Elevation 504
Steel cutoff wal - 19 ft. + long 20 inches top = 1 ft. above foundation concrete
Foundation concrete - 4 ft. into sound footing trench without forms - 6 ft. thick
R. R. rails - 15 ft. long, 5 ft. centers
10 inch bars horizontal

First Dam

Second Plan - proposed raising Lake Garda, Elevation - top of dam - 515
May 18, 1936
Ultimate height - 510 ft. (spillway)
Present flowage into - 507.4 Estimated flood level - 513.5
Plan shows corewall to Elevation 515 - 12 inches thick on top
1:2:4 concrete
Slopes of raised dam - 1:3, top width 10 ft.
Elevation spillway shows corewall to Elevation 515
Present corewall Elevation 509 on plan - elevation of spillway

Section A-A shows

Present lake	El. 504
Proposed lake	El. 507.42
Ultimate lake	El. 510
Maximum (estimated flood)	El. 513.6

Ron-Day, Inc.
Unionville, Conn.

Gentlemen:

The Board of Supervision of Dams has on several occasions advised you that, as a result of inspections made of the Lake Garda Dam, it has been found to be, in their opinion, an unsafe structure. The Board has further advised you that a section of the corewall should be raised in order to make the dam safe.

On May 9, 1945 we last wrote you pointing out the necessity of having the dam strengthened and asked that we be supplied with plans showing the details of the work to be done. This letter has not been acknowledged and neither have plans been received.

Under the provisions of Section 1055e you are now ordered to strengthen the dam by raising the corewall to the height of the existing corewall on the western section of the dam. You are further ordered to submit plans for approval by the Board not later than July 15, 1945 and to have the construction work completed on or before August 31, 1945.

We invite your attention to the penalty for failure to comply with this order as set forth in Section 1055e Cumm. Supp., Gen. Statutes, copy enclosed.

Very truly yours,
STATE BOARD OF SUPERVISION OF DAMS

S. H. Wadhams, Chairman

Copy for Mr. Clarke 5/22/46

May 22, 1946

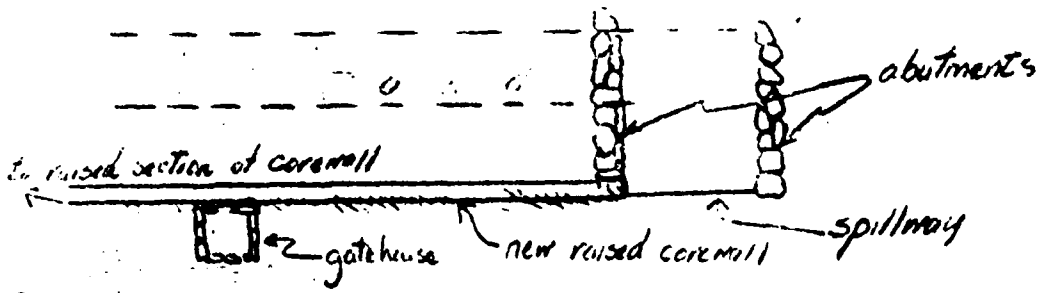
John J. Curry, Water Control Eng'r. — State Water Commission

Richard Martin, Chairman — Supervision of Dams

Lake Garda Dam
Inspection of Construction
May 21, 1946

1. Visited the site May 21. Core wall exposed for complete length of dam. Forms in place to pour additional corewall at least to the elevation of the raised wall as it exists on left side of dam.

2. The raised corewall will join the bridge abutment on the upstream face forming the most practical type of watertight joint.



3. The gatehouse is also being raised and is of cinder block construction. The corewall will be so poured that it will be integral with the downstream wall of the gatehouse, thus minimizing the possibility of leakage about the draw-off pipe.

4. The improvement will give a minimum of three feet head on spillway before endangering the abutment. The construction seems to be carried on according to good methods and at this date it is only necessary to clean the old concrete surface before pouring.

Respectfully submitted

John J. Curry.

. O. 86 Sm (11-42) 10M

INTERDEPARTMENT MAIL

Date May 27, 1946

John J. Curry, Water Control Eng'r Department State Water Commission

ention of V. B. Clarke, member Department Supervision of Dams

Lake Garda Dam
Unionville, Conn.

1. I visited the Lake Garda Dam on May 25 and discussed the recently incorporated improvements with Mr. Battistoni.

2. The raising of the corewell has been done and the job is very satisfactory from the construction methods angle. It was accomplished, as explained in my last memo.

3. The dam can now put a 3'6" head on the spillway before the corewall is overtopped. It is not intended to place fill any higher than the top of the corewall.

4. I told Mr. Battistoni that he could backfill if convenient, and I would verify with you the construction, and answer any questions you might bring up by reason of your not inspecting it personally. I, of course, said that the question of spillway capacity was still hinged on your decision, and the plans were expected, according to your request.

5. Mr. Battistoni has not received his final certificate for the upper dam (near Old People's Home) although it has been inspected and tentatively approved by you.

John J. Curry

John J. Curry, Water Control Engineer.

May 28, 1946

V. B. Clarke
356 Main St.,
Ansonia, Conn.

Mr. Richard Martin, Chairman
State Board of Supervision of Dams
Room 317 State Office Bldg.,
Hartford, Conn.

Dear Mr. Martin:

In regard to the spillway capacity of the Lake Garda Dam I am inclined to pass the same although it does not appear to be up to the recommended area. I have not had my figures verified but I estimate the capacity at 300 cu. ft., per second. The area of the water shed according to Mr. Clarence Blair's report was 2.1 sq. mi., I am inclined to think this is a little large and if it were only 1¾ sq. mi., the capacity would be just about on the line. I am enclosing the topographic map showing what Mr. Blair figured as the area and wish you would have Mr. Curry inspect the water shed particularly at the Northwesterly corner and see if I am not correct in that the area is less.

Further reasons for approval are that there are two or three other dams above with pondage which would control the flow and furthermore I seem to have in my files data which either was sent to your office by Mr. Blair or was obtained by your office indicating the hurricane flood of 3'+. I assume that it was perhaps a few inches more than 3 feet. Anyway, nothing happened at that time at this location. Apparently there is a

slow run-off, and also sandy soil in that vicinity which are all factors in considering the lower run-off.

I furthermore feel that if the spillway of the dam was to have been enlarged we should have been a little more inisistent with Mr. Battistoni in the first place that this was necessary to be done.

I will be pleased to hear Mr. Curry's check-up on the water shed area, also will you please return the section of the map to me when you are finished with it. I will also be glad of any comments you have concerning this matter but it seems to me perhaps the best way out under all of the circumstances.

Very truly yours,

VBC:M

V. B. Clarke, Member
State Board of Supervision of Dams

Lake Granada

5 - 28 - 46

Spillway 18'-6"

Height above - 3'-6"

Watershed 2 sq mi
probably less

$Q = 3.0 \times 18.5 \times 3.5^{\frac{3}{2}} = 363.5$ cu ft/sec

AB Heel tables for 2 sq mi
= 458 cu ft/sec

$\frac{363.5}{458} = 70\%$ proper capacity

if watershed area = 1.5 sq mi

$\frac{363.5}{1.5} = 240$ cu ft/sec/sq mi

or about one line

orm C. O. 881 (8-39) 1084

INTERDEPARTMENT MAIL

Date June 3, 1946

From John J. Curry, Water Control Eng'r Department State Water Commission

To attention of W. B. Clarke, Member Department Supervision of Dams

Lake Garda Dam
Drainage Area

1. A complete circuit of the drainage area was made by traversing all the roads in and about the area.

2. The inclusion of any area between roads was determined by the direction of flow through culverts and observation of the slope of the terrain in conjunction with the contours on the U.S.G.S. map of the area.

3. The map seems to be a good, fair representation of the drainage area. Although the exact line along the S.E. corner could not be observed, your suspicions of the N.E. boundary being too extensive were confirmed. It was found necessary to enlarge the area along the southern boundary.

4. The basis for the establishment of the new boundary lines is given on the accompanying overlay.

5. The area according to this new outline is 2.11 sq. mi.

6. When the new maps of the area are published, they might be a basis for a slight change in this figure in the direction of accuracy or a study of aerial photographs might give a better figure. But, in either case, I believe the change would be too small to affect our decision.

John J. Curry

Attached - section of USGS map - property of Mr. Clarke
overlay of section of USGS map.

(1) The location of the dam as shown is slightly too far downstream. A new road has been developed and the dam exists about 400' upstream from the road on the USGS maps.
(2) The drainage area boundary runs along the north at a new road: the position shown along the slight nose seems accurate.
(3) There is no question as to this boundary along the sharp ridge.
(4) This point observed from Mine Road. The area definitely extends across the road a short way to the south. Mr. Battistoni's new dam is outside the area as shown by Mr. Blair and this pond definitely is part of the watershed.
(5) The boundary definitely is to the south of Mine Road all the way to the intersection but due to the drainage line as shown by the USGS map at point (5) it is advisable to run it very close to the road up to the intersection.
(6) From the intersection it can be observed that the area extends at least to the top of hill (6) to (6a).
(7) Point (7) cannot be observed from the road but it is fair guess between the two head waters and agrees with Mr. Blair.
(8) A ridge at point (8) divides the watersheds but its location is not defined by the map.
(9) The watershed to the NW of the intersection definitely is within the drainage area so a straight line from (7) to (9) is a fair location for this boundary.
(10) Point (10) was located as .2 miles north of intersection.
(11) The area at (11) flows into a swale and enters the brook below the dam. The boundary (1) to (10) is up a well-define nose on the map.

ay of USGS Map showing
Drda Drainage Area as
rmined from field inspection
3, 1946

J.J.Curry
6/3/46

Comm. 3214-7
Lake Gardia
1946 Battistoni, Hodge

June 26th - H.-C.-Hodge & Owner: Looked over dam and photographed Said fill should be placed, rip rapped 1' above and below water level and seeded for rest. Said Board was not concerned with bathing procedure. Developed that there had been previous conferences so said to hold everything till I contacted Martin They said preliminary certificate had been issued by Caldwell. H.-P.-Martin and Wadhams: Reviewed situation. No preliminary permit issued and they must submit a plan. Then Martin will follow. I am to do nothing more. Read letter to Hodge and O.K

1953

9/2 Inspected Dam: Still needs fill and riprap & seeding.

12/16 Battistoni ~~in early~~ left plans of dam. Called him later - He will come in to discuss

12/30 Studying S.W. Comm. file.

1954

4/22 Reviewing past correspondence on project

4/23 Delivered plan and correspondence to Wise and discussed

11/14 Job insp. Nothing new.

[illegible] 10 '55 H.W.B. Job insp. - Nothing new

[illegible] 31 '55 H.W.B. Job insp. - Dam held but bridge washed out. Apparently abutments undermined by discharge

[illegible] 9 '55 H.W.B. Anthony J. Rick ~~and~~ attorney and Battistoni. Going to court next week and want final certificate. Said I thought it had been issued but will check file. Wants to widen spillway 8'. Said fine. Submit plans and if it looks OK I will approve promptly

5/9/56 JOB INSPECTION. WENT OVER WHOLE WORK IN DETAIL. IT IS 3'-9" FROM THE SPILLWAY TO THE TOP OF THE CORE WALL. THE SPILLWAY IS 19 FEET WIDE. THE WEST ABUTMENT I O.K., THE EAST ABUTMENT IS GOOD FOR 21 FEET OR TO THE NORTHERLY END OF THE PAVED APRON; IN OTHER WORDS, THERE ARE JUST THE BRIDGE ABUTMENTS THAT HAVE GONE OUT. SAW BATTISTONI. HE PLANS TO ENLARGE THE SPILLWAY WHEN HE REPAIRS AND WILL SEND IN PLANS FOR APPROVAL BEFORE HE DOES SO. MAY 9 '56 H.W.B.

JSM
10/26/56 INSPECTED SITE - NO WORK HAS BEEN DONE TO DATE

650 Main Street
Hartford 3, Connecticut

May 10, 1956

Mr. Stephen A. Flis
Town Manager
Farmington, Connecticut

Dear Mr. Flis:

In compliance with your request addressed to the office of this Board, I have inspected the dam which impounds the water of Lake Garda southwest of Unionville.

I find that the dam, including the spillway section, did not suffer structural damage as a result of the floods last year. The easterly abutment of the bridge at the spillway was washed out, collapsing the bridge. However, so far as I could determine, loss of this abutment which is entirely downstream from the spillway abutment and the spillway apron, has not in any way damaged the spillway itself.

I have made a preliminary computation of the watershed and find that the spillway has a capacity of about two-thirds that required to pass a flood meeting the 100-year requirement of this Board. However, a section of roadway west of the spillway could effectively pass the additional discharge at times of flood as a thin sheet of water, without endangering the structure. I have conferred with the owner, Mr. Battistoni, and have been advised that he plans to remove the bridge and its abutments entirely, backfill the areas which have washed out in this vicinity, fill and rip rap the upstream face of the dyke, and increase the width of the spillway by approximately 50%, which will more than meet the Board's requirements. He has been instructed to complete plans for this work and submit them to the Town Clerk of Farmington in accordance with the Revised Statute. As soon as they are forwarded to this Board they will be checked for safety and if found satisfactory the requisite construction permit will be issued.

Sincerely yours,

STATE BOARD FOR THE SUPERVISION OF DAMS

HWB/H
CC: Mr. William S. Wise
Mr. Harry J. Battistoni

Henry Wolcott Buck

FORM D-4

STATE OF CONNECTICUT
WATER RESOURCES COMMISSION
Room 317 State Office Building
Hartford, Connecticut

APPLICATION FOR CONSTRUCTION PERMIT

As required under Section 19 of Public Act No. 364
of the 1957 Session of the General Assembly

THIS APPLICATION TO BE SUBMITTED IN TRIPLICATE

Date JULY 2, 1957

Owner HARRY BATTISTONI

P. O. Address BURLINGTON
CONNECTICUT

Tel. No.

Location of Structure:

Town FARMINGTON Shown on USGS Quadrangle BRISTOL

Name of Stream UNIONVILLE BROOK at 0.77 inches ~~south~~ north of Lat. 41° 45'
abd 2.66 inches ~~east~~ west of Long 72° 52' 30"

Directions for reaching site from nearest village or route intersection:
(see sketch on reverse side)
FROM THE BRIDGE OVER THE FARMINGTON RIVER ON ROUTE 177 IN THE VILLAGE OF UNIONVILLE PROCEED SOUTHERLY ON ROUTE 177, 0.7 MILE TO INTERSECTION. PROCEED WESTERLY ON PAVED ROAD 0.6 MILE TO INTERSECTION. PROCEED SOUTHWESTERLY ON PAVED ROAD 0.05 MILE TO DAM.

This is an application for: ~~(New Construction)~~ (Alteration) (Repair) ~~(Removal)~~
(check one or more of above)

This pond is to be used for: RECREATION

Dimensions of pond: width 200 TO 600 FEET length 3600 FT. area

Maximum depth of water immediately above dam: 13 FEET±

Total Length of dam: 250 FEET

Length of spillway: 29.5 FEET

Height of abutments above spillway: 3' 9"

Type of spillway construction: MASONRY

Type of dyke construction: EARTH FILL WITH CONCRETE CORE

Spillway section will be set on: ~~(Bedrock)~~ (Gravel) ~~(Clay)~~ ~~(Silt)~~ x
(check one of above)

Remarks: SEE PLANS ATTACHED AND ALSO PLANS SUBMITTED WITH PREVIOUS APPLICATION DATED FEB. 1, 1946 PREPARED BY J.D. WILLIAMS UNDER WHICH A CONSTRUCTION PERMIT WAS ISSUED AND UNDER WHICH CONSTRUCTION WAS NOT COMPLETED

Note: Show details of construction on reverse side.

Signed [signature]

B-15

LAKE GARDA COMPANY, INC.
Harry J. Battistoni, Pres.
BUILDERS-Developers-Realty

HOME OFFICE
Unionville, Conn.
Orchard 3-9433

LAKE GARDA CLUB
Orchard 3-2682

Copy Sent To:

July 12,1957

Mr.V.B. Clarke, Member of Board of Supervision of Dams
356 Main Street
Ansonia, Conn.

Water Resources Commission
Romm 317, State Office Bldg.
Hartford 15, Conn.

Dear Sirs;

I have your letter dated June 27th.,1947 pertaining tc the completion of the Dam at Lake Garda and the necessity of extensive repairs.

The ownership of the Dam,Lake and Dam Area has not changed since June 1947 still belonging to Lake Garda Co.,Inc. The recovery of the Lake and Dam and Dam Area was returned to me Oct.24th., 1945 from Ron-Day, Inc. and with it I inherited the gloomy and humiliating and most expensive rebuilding of the Dam, new core wall, fill for hight grading of spillway channel from Ron-Day, Inc. The Attorney General and the Board of Engineers were after Ron- Day, Inc. for a peroid of nine years to carry out the compeltion of the Dam and its responsibility to the State and people without any success.

The floods of 1955 has caused extensive damage to the parapet wall, the bridge at the spillway and destroyed the bed of spillway rock and rip-rap over the major part and length of the channel waterway.

I recently submitted to the present commission on Water sketches for the widening of the mouth of the spillway to increase the flow of water off the waterfall. A reinspection of the site and any suggestions which you might make would be greatly appreciated. Although no change of ownership has occured since my preliminary application for construction and repair permit filed with you in 1947 the place has been over-run by trespassers who continue to use and misuse the Dam Site for spiteful purposes notwithstanding the fact that their illegal use weakens and destroys the safety of the structure. These trespassers have erected flimsy barricades, a temporary foot bridge over the collapsed side walls of the spillway, dumped rocks against the weakened east side of the spillway

wall, removed fill from the top surface of the Dam for the selfish purpose of providing parking area at the Dam Site.

During the last ten years about 3400 yards of fill has been destroyed and washed away at the south portion facing the Lake core wall. The 16" drain pipe becomes plugged by the disturbance of the sand at this area by the swimming of these trespassers. Had I not cleaned this drain and make it operative two months before the flood the Dam would have been completly destroyed.

During the last several years four trespassers have lost their lives because of the dangerous dept for swimming at this area. Only two weeks ago a child five years old was was the latest victim.

I am determined and anxious to complete the necessary repairs at this site, and to do whatever may be necessary the safety of the Dam.

I know that Mass. and New York have stringent laws to protect Dams against misuse destruction or trespass or from interfering with the mormal functioning of a Dam. I would appreciate being advised what Conn. does to protect the lives and property and ownership of those in the area of a Dam.

If I might have a immediate inspection of the area I will proceed at once with the reconstruction and will then attempt through an injunction to keep the trespassers from further misuse of the Dam and the Dam Area.

Yours truly,

Lake Garda Co., Inc.
Harry Battistoni, Pres.

June 24, 1960

Mr. Henry W. Buck
Buck & Buck, Engineers
650 Main Street
Hartford, Connecticut

Re: Lake Garda Dam
Farmington, Connecticut

Dear Mr. Buck:

Upon notification from you that the alterations and repairs to the subject dam, for which a Construction Permit was issued by this Commission on July 19, 1957, had been completed, and inspection was made on June 8, 1960.

It was found that a stone wall has been constructed on the east side of the spillway in place of the rip-rap shown on the plans. This wall will not serve to protect the embankment as, during times of high water level, water will extend along the east side of the wall. We, therefore, request that you inform the owner that it will be necessary for him to rip-rap this section of the dam in the manner and to the extent shown on the plans approved by this Commission before a Certificate of Approval will be issued.

We further noted that approximately the final 50 feet at the westerly end of the dam has not been rip-rapped and grassed in accordance with the plans. It is our understanding that Lake Garda Company may not own this section of the dam. If at all possible, we feel it would be well worth while for the Company to perform this work.

Very truly yours,

Merwin E. Hupfer
Senior Sanitary Engineer

MEH:gd

SUPERVISION OF DAMS
INVENTORY DATA

LONG 72-54.01
LAT 41-44.7

Inventoried By T.C.

Date 6-17-63

Name of Dam or Pond Lake Garda Dam

Code No. F 38.5 [illegible] 10

Nearest Street Location

Town Farmington

U.S.G.S. Quad. Bristol

Name of Stream [illegible]

Owner Lake Garda Company

Address c/o Mr. Battistoni
Farmington

#12 [illegible] 7/73

Pond Used For Recreation

Dimensions of Pond: Width ______ Length ______ Area 38.0 acres

Total Length of Dam 80' Length of Spillway 20'

Location of Spillway East End Of Dam

Height of Pond Above Stream Bed 13'

Height of Embankment Above Spillway 4'

Type of Spillway Construction Stone Concrete

Type of Dike Construction Stone Concrete + Earth

Downstream Conditions Road 100' - Cottages 50'

Summary of File Data Construction permit for repairs issued 7/19/57 by this office

Remarks Appears to be in good condition

Would Failure Cause Damage? Yes Class B

B-19

M PUR STO 201

INTERDEPARTMENT MAIL

DATE: July 1, 1968

TO: File — DEPARTMENT:

FROM: William H. O'Brien III — DEPARTMENT:

SUBJECT: Lake Garda Dam, Farmington

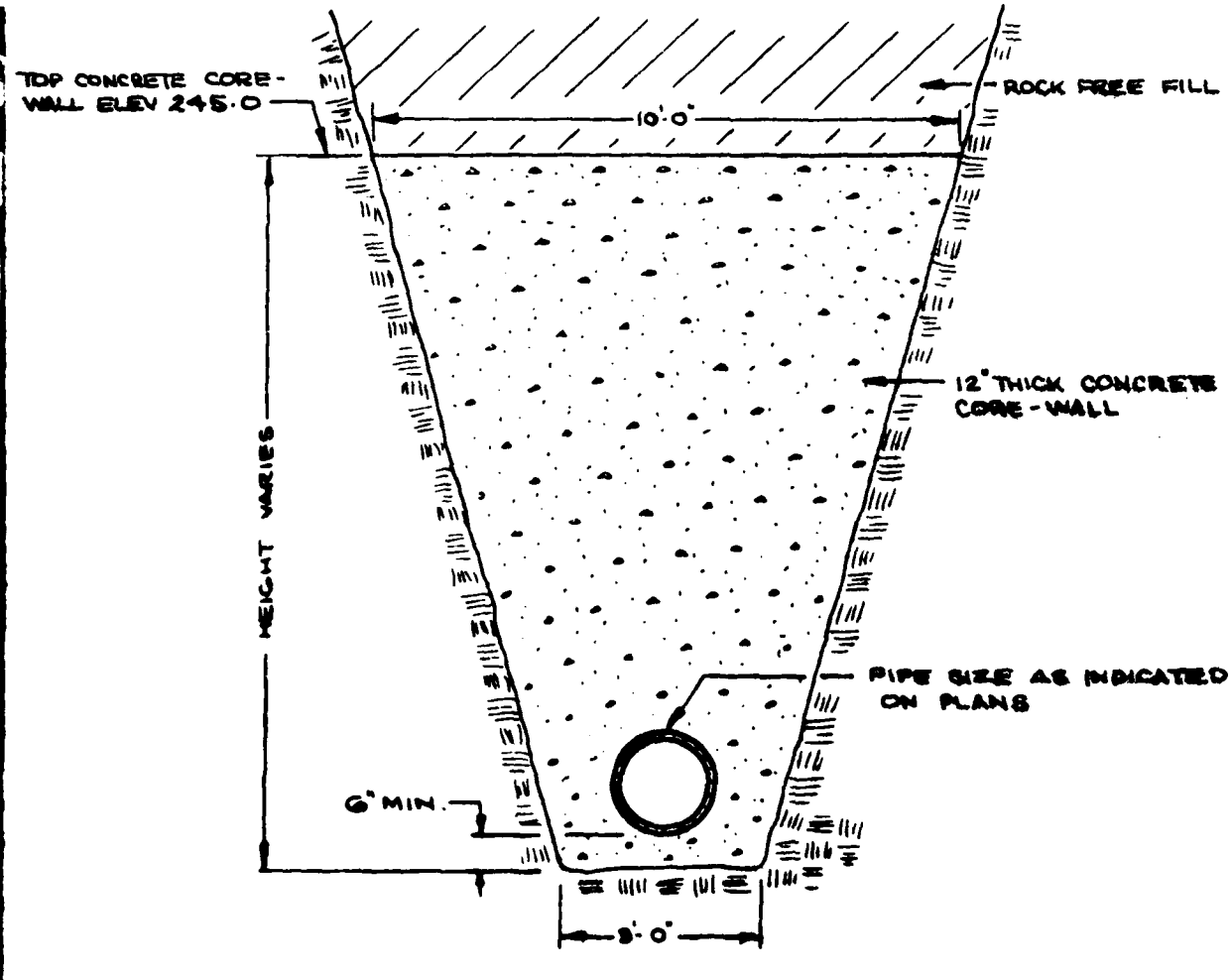
On July 1, 1968, I received a telephone call from Attorney Paul Orth (249-6891) inquiring if it was necessary to get a Construction Permit to raise the spillway of a dam. I said this was a major change requiring a permit.

He then said that the water level at Lake Garda had been raised approximately 6 inches by the construction of a concrete weir, and that he thought this may have been done this Spring. I told him the last thing we had in our file on this dam was a letter from our consultant dated May 14, 1965 stating that everything was satisfactory.

The spillway was widened per plans dated June 25, 1957 prepared by Buck and Buck Engineers and a Certificate of Approval issued October 3, 1960. This involved the construction of a new concrete spillway and wing walls. The drainage area to this lake, according to above plans, is a 2.26 mi^2 with Q_{100} = 710 CFS. With this flow thru the spillway there would be 2 feet of freeboard to the top of the dam. From pictures, it appears that the dam which would cause damage if it failed. If the spillway were raised 6 inches, this would allow for a freeboard of 1 1/2 feet which would probably be adequate.

Mr. Orth will write a letter to Mr. Curry, Director, describing the situation. We will look at the dam either before or after we hear from Mr. Orth.

William H. O'Brien III



SPECIAL DETAIL
12" THICK CONCRETE CORE-WALL AT DAM
STA. 3+00 LAKE GARDA INTERCEPTOR
STA. 4+40 WASHINGTON CIRCLE INTERCEPTOR

1.16.17

ESTABLISHED 1887

S. E. MINOR & CO., INC.
CIVIL ENGINEERS
161 MASON STREET
GREENWICH, CONNECTICUT 06830

October 2, 1975

State of Connecticut
Department of Environmental Protection
State Office Building
Hartford, Connecticut 06115

Attention: Mr. Victor F. Galgowski
Superintendent of Dam Maintenance
Water and Related Resources

Re: Lake Garda Dam
Farmington, Connecticut

Dear Mr. Galgowski:

In accordance with your request, we have examined the subject dam in order to ascertain its structural soundness and stability. Prior to our visit to the site, we went to the Town Hall offices and attempted to obtain any structural drawings of the subject installation. We were advised that no plans were on file and that the Town officials had no knowledge whatsoever of the construction of the dam.

Upon visiting the site, we examined the structure, which consists of a combination of earth dam with rubble masonry slope and a cement rubble masonry cheek walls together with poured concrete spillway. The rubble slope on the back of the dam has approximately a one on three slope. There is generally three feet of freeboard, and there was no evidence of overtopping.

The earth portion of the dam appears to be structurally sound with no evidence of leaks, boils, or fissures on the face or at the toe. The spillway itself, however, is in need of general cleanup of debris and repair. The poured concrete section of the spillway and cheek walls is badly deteriorated and should be replaced. For the most part, the cement rubble masonry portion needs only general pointing up and rechinking.

The section of the spillway which is taking the flow is approximately five feet wide. The flume thereby created has tended to destroy portions of the cement rubble cheek walls.

The enclosed sketch indicates the area of the spillway where the flume is presently running which is the area in need of repair. Farther downstream where the spillway is approximately 15 feet wide as indicated on the sketch, there is a tremendous amount of debris (rocks, wood, limbs, weeds, etc.) which should be cleaned up and removed from the area.

It is our considered opinion that the dam is structurally sound and that the maintenance and repairs mentioned above should be completed as soon as possible. When this is completed, the dam should remain serviceable for many years:

Respectfully submitted,

S. E. MINOR & CO., INC.

Edward F. Ahneman, Jr., P.E.
Chief Engineer

EFA:lb
Enclosure

APPENDIX C

DETAIL PHOTOGRAPHS

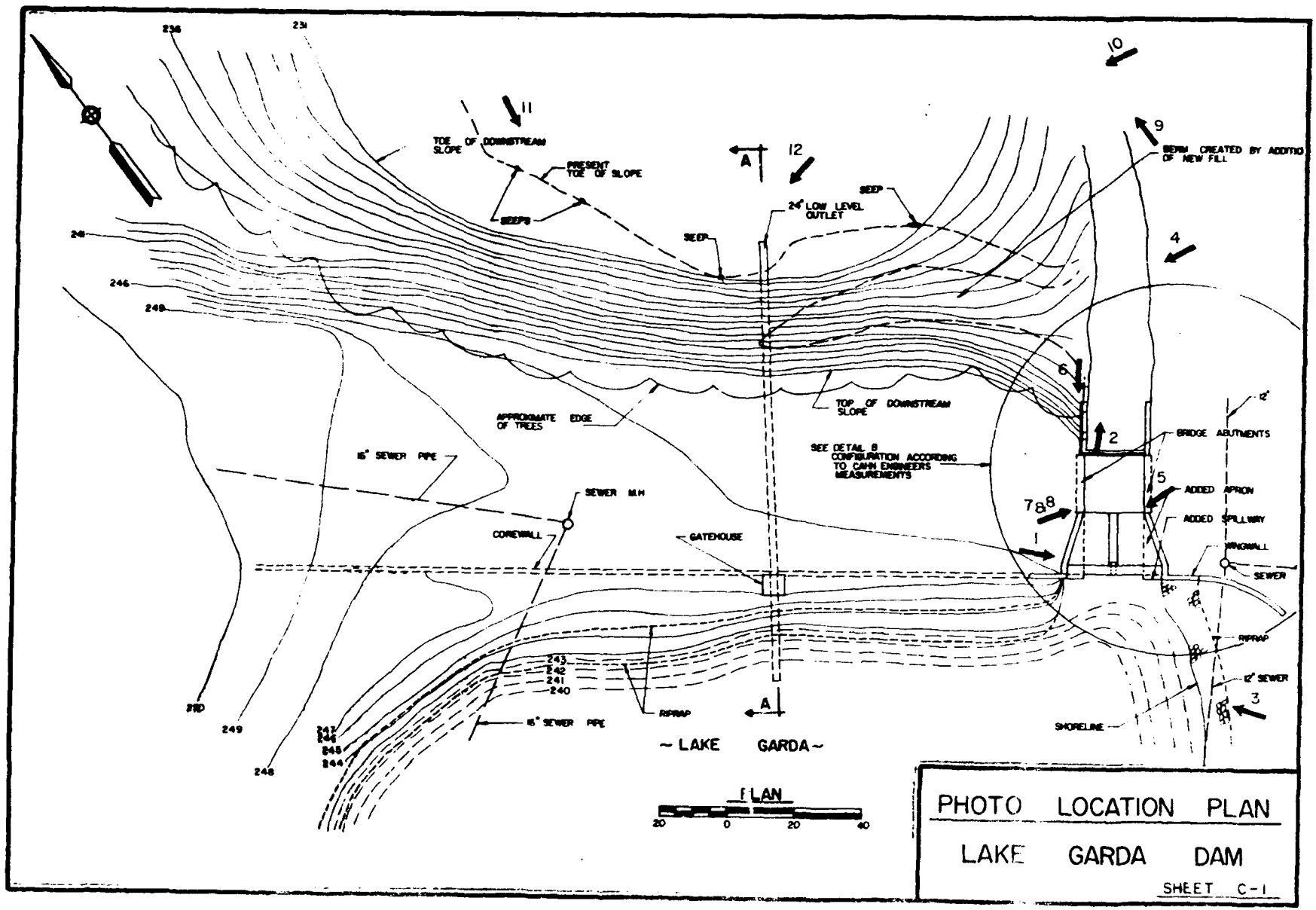

TOE OF SLOPE OF DOWNSTREAM
PRESENT TOE OF SLOPE
SEEPS
SEEP
24" LOW LEVEL OUTLET
BERM CREATED BY ADDITION OF NEW FILL
TOP OF DOWNSTREAM SLOPE
APPROXIMATE EDGE OF TREES
SEE DETAIL B CONFIGURATION ACCORDING TO CAHN ENGINEERS MEASUREMENTS
BRIDGE ABUTMENTS
ADDED APRON
ADDED SPILLWAY
WINGWALL
SEWER
RIPRAP
12" SEWER
SHORELINE
15" SEWER PIPE
SEWER M.H
COREWALL
GATEHOUSE
~ LAKE GARDA ~
PLAN
20 0 20 40
PHOTO LOCATION PLAN
LAKE GARDA DAM
SHEET C-1

PHOTO 1 - Spillway and right masonry training wall at right end of dam (October, 1978).

PHOTO 2 - Spillway discharge channel and low-lying house immediately downstream of dam (April, 1979).

US ARMY ENGINEER DIV. NEW ENGLAND CORPS OF ENGINEERS WALTHAM, MASS	NATIONAL PROGRAM OF INSPECTION OF NON-FED. DAMS	Lake Garda Dam Unionville Brook Farmington, Connecticut CE # 27 595 KB DATE July '79 PAGE C-1
CAHN ENGINEERS INC. WALLINGFORD, CONN. ENGINEER		

PHOTO 3 - Upstream slope, gatehouse and crest viewed from right end. Note area on slope where riprap is absent. Section of concrete corewall in spillway training wall visible in right foreground (April, 1979).

PHOTO 4 - General view of downstream slope of dam showing berm created by addition of material to slope. (April, 1979.)

PHOTO 5 - Left spillway training wall. Note deterioration of older concrete section of wall. Old width of spillway defined by base of concrete wall not removed during spillway widening (April, 1979).

PHOTO 6 - Downstream end of left training wall appears to have moved slightly away from embankment (April, 1979).

US ARMY ENGINEER DIV. NEW ENGLAND CORPS OF ENGINEERS WALTHAM, MASS	NATIONAL PROGRAM OF	Lake Garda Dam Unionville Brook Farmington, Connecticut
CAHN ENGINEERS INC. WALLINGFORD, CONN. ENGINEER	INSPECTION OF NON-FED. DAMS	CE # 27 595 KB DATE July '79 PAGE C-3

PHOTO 7 - Right spillway training wall prior to repairs (April, 1979).

PHOTO 8 - Right spillway training wall after repairs (June, 1979).

PHOTO 9 - Obstruction of spillway discharge channel looking downstream from right abutment. Note flow exiting from left side of channel (April, 1979).

PHOTO 10 - View of channel obstruction and downstream toe from right channel bank. Note uprooted tree to right of center near top of photo (January, 1979).

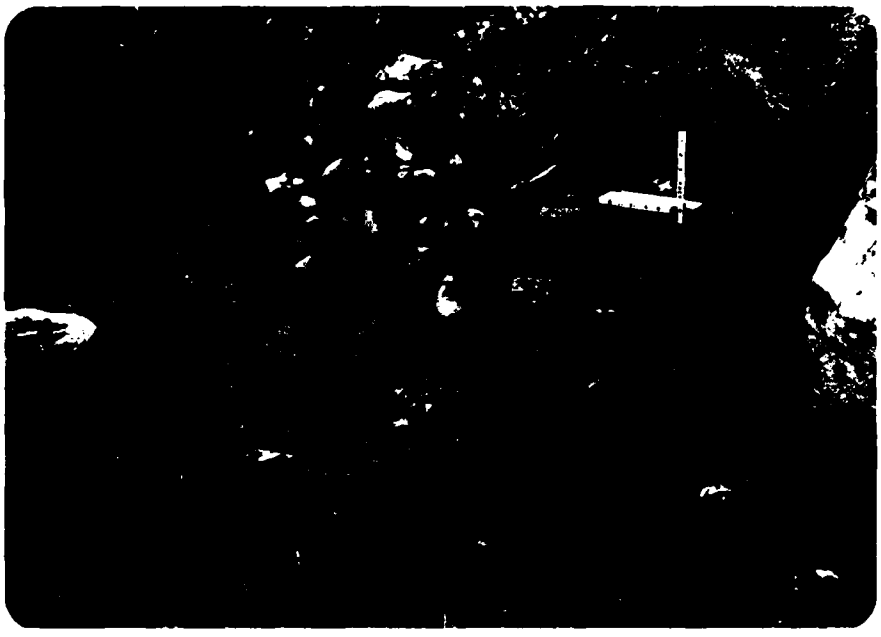
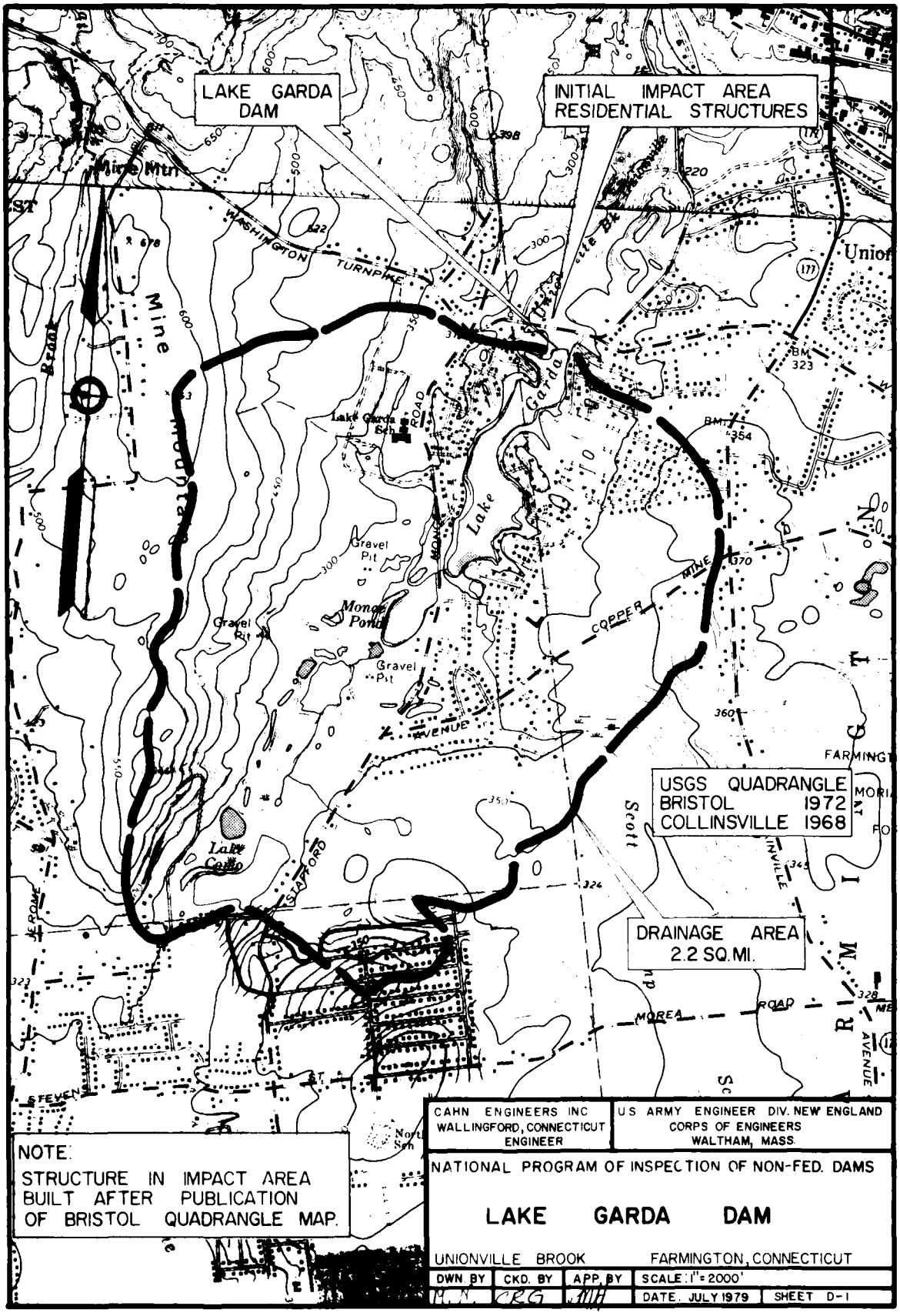


PHOTO 11 - Seep at left toe of dam which is largest of four seeps through dam (April, 1979).

PHOTO 12 - Downstream end of low level outlet pipe. Note deterioration of top of pipe, slight flow through pipe, and standing water at toe of dam (April, 1979).

APPENDIX D

HYDRAULIC/HYDROLOGIC COMPUTATIONS



CAHN ENGINEERS INC
WALLINGFORD, CONNECTICUT
ENGINEER

US ARMY ENGINEER DIV. NEW ENGLAND
CORPS OF ENGINEERS
WALTHAM, MASS.

NATIONAL PROGRAM OF INSPECTION OF NON-FED. DAMS

LAKE GARDA DAM

UNIONVILLE BROOK FARMINGTON, CONNECTICUT

DWN. BY	CKD. BY	APP. BY	SCALE: 1" = 2000'
M.N.	CRG	JMH	DATE: JULY 1979

SHEET D-1

Hydrologic / Hydraulic Inspection

Lake Garda, Farmington Conn.

1. Performance @ test flood Conditions
PMF
a) Watershed classified as rolling
b) i Watershed Area = 2.26 Sq miles
(Buck & Buck 6/24/57 verified by:
1. Curry WRC 6/3/46 2.11 SM
2. Doll, CE 6/1/78 2.16 SM)
ii DA above Manor Pond 0.98 SM
(Doll, CE 6/1/78)

c) i From NED Preliminary Guidance for estimating Maximum Probable Discharges dated March 1978:

PMF = 2100 cfs/sm

d) Peak inflow from entire drainage Area =

2.26 sm × 2100 cfs/sm ≈ 4750 cfs

Lake Garda (Continued)

2/ Spillway design flood (SDF) - (Test flood)

(a) Classification of Dams according to NED USACE guidelines:-

i height:

a. WRC Records 13' @ el 504 spillway } old Williams datum
Spillway later raised to 507.25
∴ Say height ≈ 16.00' to Spillway as designed

b. Inventory of dams hydraulic height = 15.6'
" - structural height = 17.0'

c. JD Williams 2/1/46 Plan shows 16' full height.

d. CE measure spillway 2.6 to 2.9' deep above 6" step probably added to Buck & Buck design 7/1/68 WRC Memo

Height For Breach Computations @ Top of Dam; USE 17.0' Feet to top * FOR 14.0 ft to spillway BREACH

ii Storage:

a. Inventory of Dams: Normal 198 Ac ft Maximum 228 Ac ft
Δ = 30 ac ft

Since WRC records show Lake Garda @ 40 acres, and CE (WOD) checks Garda @ 37 acres± plus Monce @ 5 acres±; a Δ of 30 acre feet is not possible for a normal to max 3 foot rise (3 foot x 40 acres = 120 Acre feet)

b. CE checks
(*could be as low as ½)
*⅓ x 37 acres x 14' (see * above) = 173 acre ft
plus 3' x 40 acres± = 120 acre ft
Pool @ top of Dam el 247 :. 293 A-ft Storage

D-2

Lake Garda (Continued)

2/ Spillway design flood - (Test flood)

(a) ii Hazard potential:
Dam is 250' directly upstream of two houses that are approximately 6 feet above the normal level of Unionville Brook as it has been diverted. However the floor elevation of the house just to the right of the spillway is within one foot of the water surface elevation of the diversion. The "diversion" is a rock pile which would fail in the event of breach

iii Classification
Size : Small
Hazard: High

b) SDF = PMF = 4,750 cfs
½ PMF = 2,375 cfs

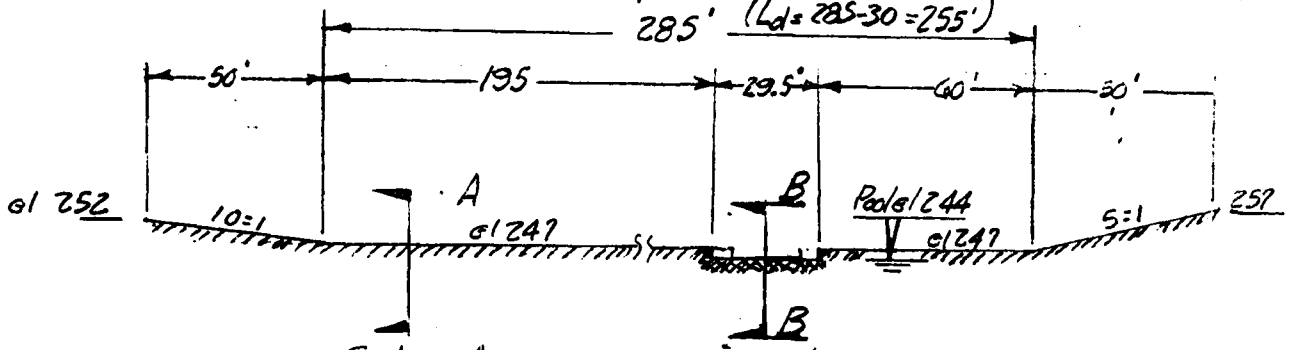
3/ Surcharge at peak Inflow

a) Peak inflow = 4750 cfs = Q_{P1}

Q'_{P1} = ½ PMF = 2375 cfs

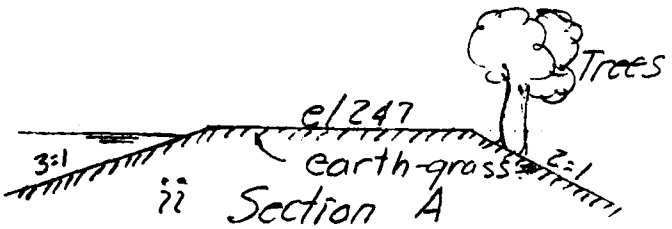
Lake Garda: 3b Spillway Rating Curve

i Dam Elevation looking downstream (1"=40')



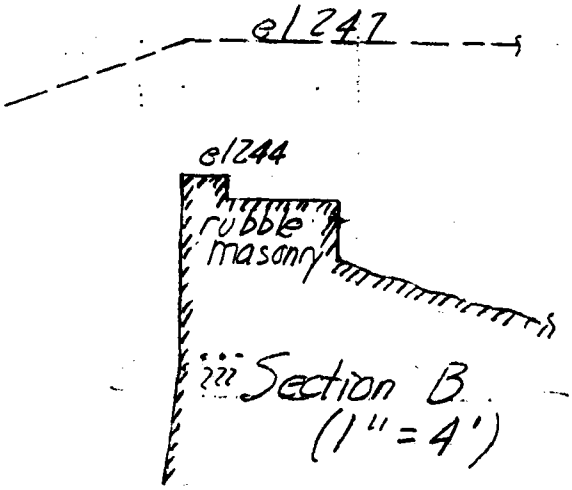
Section A through Dam

Section B through Spillway



ii Section A (1"=40'

Discharge Coefficient = 3.0



iii Section B (1"=4')

Discharge Coefficient = 3.0

Lake Garda

3(b)(iv) As shown on the previous page, the 29.5' spillway has a sharp edge and a discharge coefficient of only 3.0 thus

$Q_{SPILLWAY} = Q_S = 3.0 * h^{3/2} \times 29.5 = 89\, h^{3/2}$

(v) The dam itself is 285' long thus, with the spillway excluded it is only 255' long

$Q_{dam\ center} = Q_d = 3.0\,(h-3)^{3/2} \times 255 = 765(h-3)^{3/2}$

(vi) On the right, the dam abutment slopes upward 10' in 50', thus the water surface length is: $(h-3)\frac{50}{10}$; equivalent length $\approx 2/3$ length

So $Q_{right\ abutment} = Q_R$

$Q_R = 3.0 \times (h-3)^{3/2} \times (h-3)\frac{50}{10} \times \frac{2}{3}$

$Q_R = 10(h-3)^{5/2}$

vii) Similarly, on the left, the abutment slopes 5' in 50' so

$Q_{Left\ abutment} = Q_L = 20(h-3)^{5/2}$

viii) The total overflow = $Q_S + Q_d + Q_R + Q_L = Q_T$

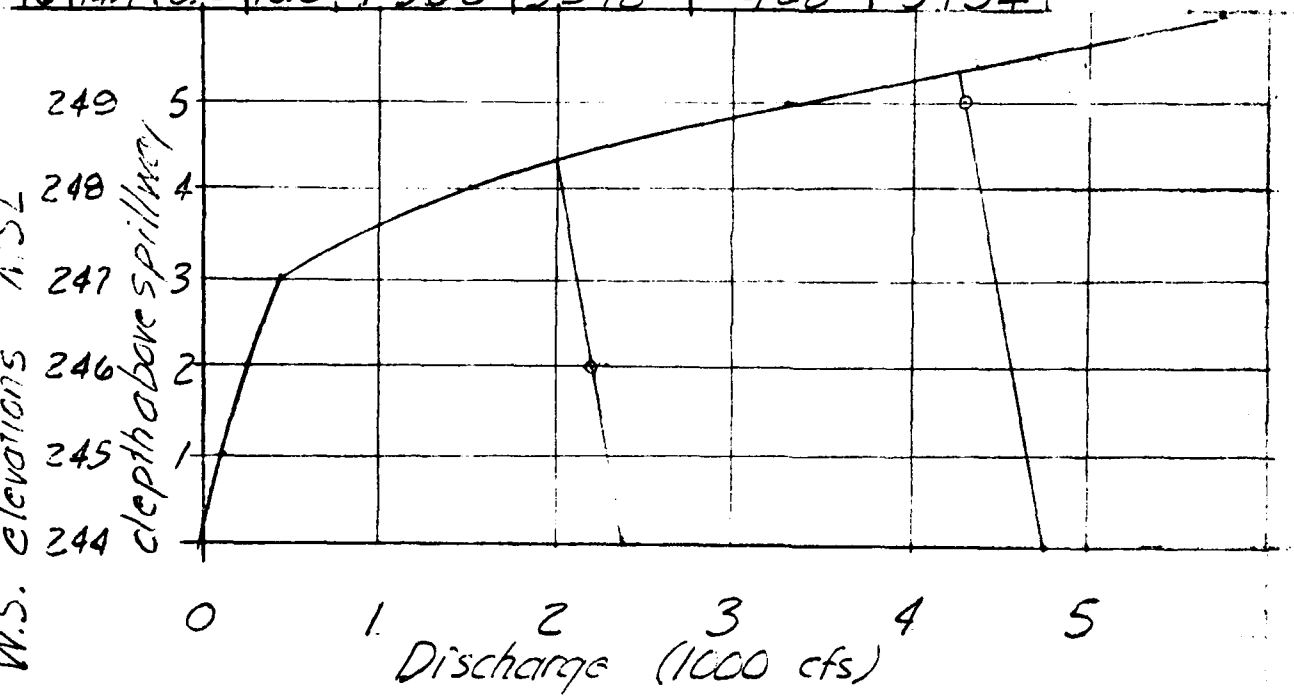
$$Q_T = 89\,h^{3/2} + 765(h-3)^{3/2} + 30(h-3)^{5/2}$$

This is the overflow rating curve

* h is always the water height above spillway el 244.5

Lake Garda (3b)(ix) Spillway / Dam Rating Curve

h above spillway				Spillway	Dam	Abuts.	total flow
h	$h^{3/2}$	$(h-3)^{3/2}$	$(h-3)^{5/2}$	$89h^{3/2}$	$765(h-3)^{3/2}$	$30(h-3)^{5/2}$	Q_{Total}
1	1	—	—	89	—	—	89
2	2.8	—	—	250	—	—	250
3	5.2	—	—	463	—	—	463
4	8.0	1.0	1.0	712	765	30	1507
5	11.2	2.8	5.6	996	2142	168	3306
6	14.7	5.2	15.6	1308	3978	468	5754



3(c) Spillway Capacity @ top dam = 463 cfs
@ PMF = 463 ÷ 4750 = 10% Q_{PI}
@ ½ PMF = 463 ÷ 2375 = 20% Q_{PI}

3(d) Surcharge to pass Q_{PI} h ≈ 5.3' @ PMF
Surcharge to pass Q_{PI} h ≈ 4.3 @ ½ PMF

D-6

Lake Garda

4) a) Effect of Surcharge on maximum probable discharge
Lake Area 37 acres @ spillway el 244
assume avg area 40 acres between el 244 & 250
(See (3b ix) & (2a ii))

b) normal pool @ el 244

c) Watershed Area 2.26 s miles (1446 acres)

d) Assume Q_{P2} @ h = 5', 2'

i S_T = Storage = $40 \times 12 \times 5 = 2400$ acre inches
$40 \times 12 \times 2 = 960$

ii expressed in inches over the entire 1446 acre basin,
this is $\frac{2400}{1446}$ = 1.7" of storage = STOR$_1$ @ h=5

iii $Q_{P2} = Q_{P1}\left(1 - \frac{STOR_1}{19}\right) = 4750 \times .91 \approx 4300$ cfs
Q_{P2}

iv from chart (pg 6) Q_{P3} @ PMF = 4250 cfs

v $\frac{960}{1446}$ = 0.7" of storage @ h=2 = STOR$_1$'

vi $Q_{P2}' = Q_{P1}'\left(1 - \frac{STOR_1'}{9.5}\right) = 2375 \times .93 = 2200$ cfs
Q_{P2}

vii from chart (pg 6)
Q_{P3}' @ ½ PMF = 2000 CFS

Lake Garda

5) Summary Performance @ Test Flood Conditions

a) Peak Inflow : Q_{P_1} = PMF = 4750 cfs
Q'_{P_1} = ½ PMF = 2,375 cfs

b) Peak Outflow Q_{P_3} = 4,250 cfs
Q'_{P_3} = 2,000 cfs

c) Spillway Max Capacity = 463 cfs or:
10% of Q_{P_3} and
20% Q'_{P_3}

d) Therefore, the spillway will not contain the test flood
@ SDF = PMF the dam will be overtopped 2'+
@ SDF = ½ PMF the dam will be overtopped 1'+

D-8

Cahn Engineers Inc. Consulting Engineers

Project: Non Fed. Dam Inspection | Sheet 9 of 9
Computed By: D | Checked By: [illegible] | Date: 6/4/[illegible]
Field Book Ref. | Other Refs: 27595 KB | Revisions

Lake Garda

II Downstream Failure hazard

1) Peak failure outflow [illegible]

a) breach width:

i Mid height [illegible] (@ el 1253±) = 300'

ii breach width (USED)

0.4 × 300 = 120' = W_b

b) Peak failure outflow, W.S. el @ top dam el 1247

i Y_0 = 17 @ time failure

ii spillway discharge @ time failure 463 cfs (3 of 9)
D/S channel will be flowing 2' ± deep.

iii Peak Failure outflow @ Breach = Q_{P1} (failure)

$$Q_{P1}(\text{failure}) = \frac{8}{27}\, W_b \sqrt{g}\; Y_0^{3/2}$$

$$\left(\frac{8}{27}\right)(120)\sqrt{g}\,(17)^{3/2} \cong 14,100 \text{ CFS} \; Q_{P1}$$

c) Flood Stage at immediate downstream impact area (@ the two houses 200 ft below the Dam)

Y_N = Flood depth due to breach @ immediate impact area = $0.44 Y_0$ = 7.5'

d) Thus the [illegible] *6' ± above normal stream could be [illegible]

2) Summary:

a) Peak failure outflow 14,100 cfs

b) Flood depth immediately d/s from Dam $Y_2 = 7.5'$

c) Approximate stage before failure y_1 = 2.0'

d) raise in stage after failure y_2 = 5.5.

* See 2/(a) ii on comp sheet #3 of 9

PRELIMINARY GUIDANCE
FOR ESTIMATING
MAXIMUM PROBABLE DISCHARGES
IN
PHASE I DAM SAFETY
INVESTIGATIONS

New England Division
Corps of Engineers

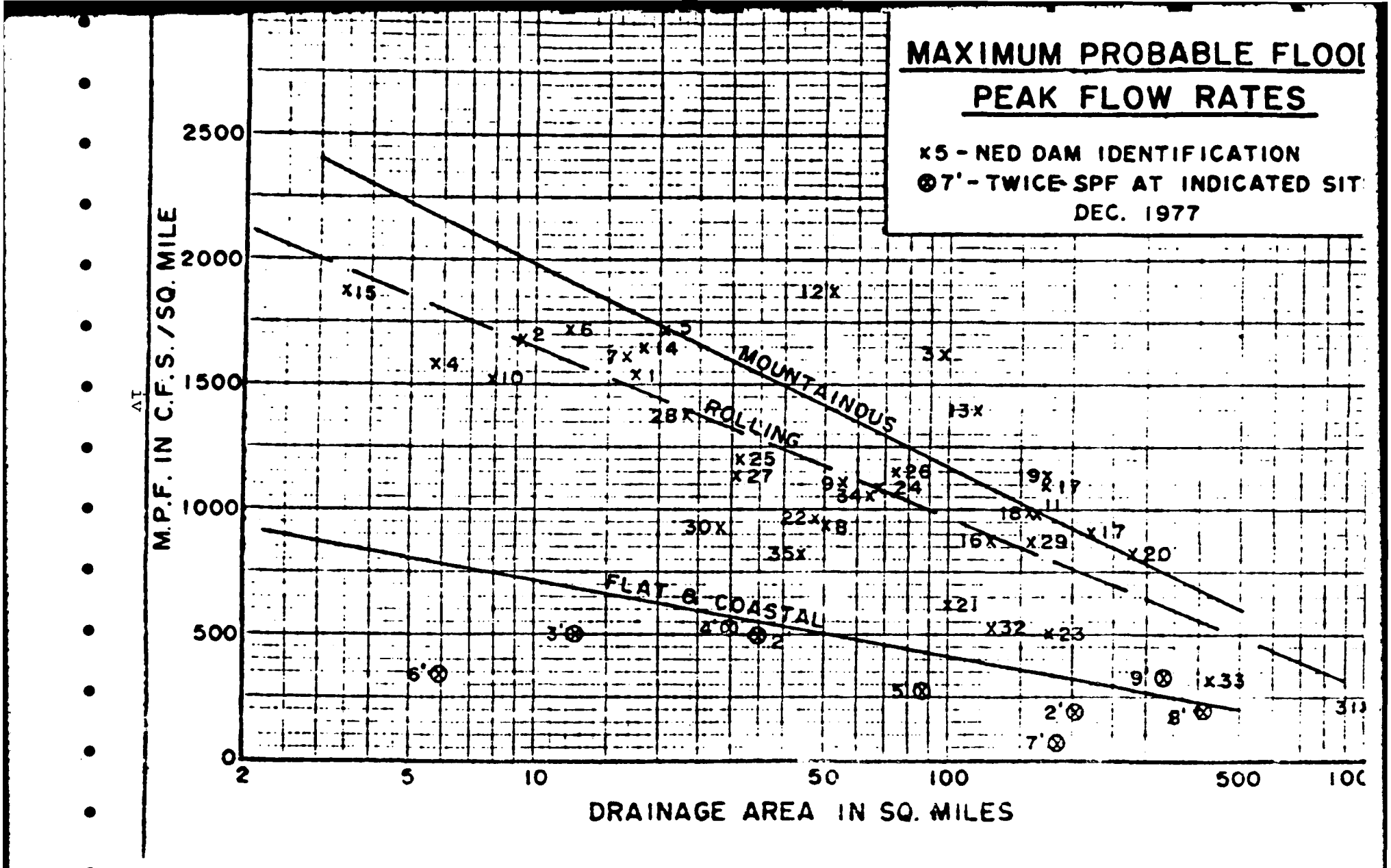
March 1978

MAXIMUM PROBABLE FLOOD INFLOWS
NED RESERVOIRS

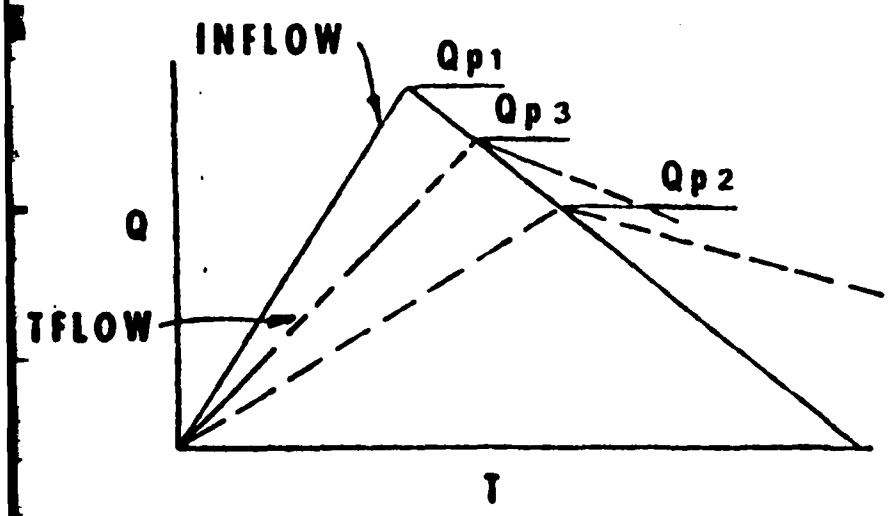
	Project	Q (cfs)	D.A. (sq. mi.)	MPF cfs/sq. mi.
1.	Hall Meadow Brook	26,600	17.2	1,546
2.	East Branch	15,500	9.25	1,675
3.	Thomaston	158,000	97.2	1,625
4.	Northfield Brook	9,000	5.7	1,580
5.	Black Rock	35,000	20.4	1,715
6.	Hancock Brook	20,700	12.0	1,725
7.	Hop Brook	26,400	16.4	1,610
8.	Tully	47,000	50.0	940
9.	Barre Falls	61,000	55.0	1,109
10.	Conant Brook	11,900	7.8	1,525
11.	Knightville	160,000	162.0	987
12.	Littleville	98,000	52.3	1,870
13.	Colebrook River	165,000	118.0	1,400
14.	Mad River	30,000	18.2	1,650
15.	Sucker Brook	6,500	3.43	1,895
16.	Union Village	110,000	126.0	873
17.	North Hartland	199,000	220.0	904
18.	North Springfield	157,000	158.0	994
19.	Ball Mountain	190,000	172.0	1,105
20.	Townshend	228,000	106.0(278 total)	820
21.	Surry Mountain	63,000	100.0	630
22.	Otter Brook	45,000	47.0	957
23.	Birch Hill	88,500	175.0	505
24.	East Brimfield	73,900	67.5	1,095
25.	Westville	38,400	99.5(32 net)	1,200
26.	West Thompson	85,000	173.5(74 net)	1,150
27.	Hodges Village	35,600	31.1	1,145
28.	Buffumville	36,500	26.5	1,377
29.	Mansfield Hollow	125,000	159.0	786
30.	West Hill	26,000	28.0	928
31.	Franklin Falls	210,000	1000.0	210
32.	Blackwater	66,500	128.0	520
33.	Hopkinton	135,000	426.0	316
34.	Everett	68,000	64.0	1,062
35.	MacDowell	36,300	44.0	825

MAXIMUM PROBABLE FLOWS BASED ON TWICE THE STANDARD PROJECT FLOOD (Flat and Coastal Areas)

River	SPF (cfs)	D.A. (sq. mi.)	MPF (cfs/sq. mi.)
1. Pawtuxet River	19,000	200	190
2. Mill River (R.I.)	8,500	34	500
3. Peters River (R.I.)	3,200	13	490
4. Kettle Brook	8,000	30	530
5. Sudbury River.	11,700	86	270
6. Indian Brook (Hopk.)	1,000	5.9	340
7. Charles River.	6,000	184	65
8. Blackstone River.	43,000	416	200
9. Quinebaug River	55,000	331	330


MAXIMUM PROBABLE FLOOI
PEAK FLOW RATES
x5 - NED DAM IDENTIFICATION
⊗7' - TWICE SPF AT INDICATED SIT
DEC. 1977
M.P.F. IN C.F.S./SQ. MILE
DRAINAGE AREA IN SQ. MILES
2500
2000
1500
1000
500
0
2
5
10
50
100
500
MOUNTAINOUS
ROLLING
FLAT & COASTAL
x15
x4
x10
x2
x6
x5
x14
x1
12x
3x
13x
28x
x25
x27
x26
x24
9x
34x
22x
x8
30x
35x
9x
x17
16x
x29
x17
x20
x21
x32
x23
3'⊗
4'⊗
2
6'⊗
5⊗
9'⊗
x33
2'⊗
8'⊗
7'⊗
31

ESTIMATING EFFECT OF SURCHARGE STORAGE ON MAXIMUM PROBABLE DISCHARGES



STEP 1: Determine Peak Inflow (Qp_1) from Guide Curves.

STEP 2: a. Determine Surcharge Height To Pass "Qp_1".

b. Determine Volume of Surcharge ($STOR_1$) In Inches of Runoff.

c. Maximum Probable Flood Runoff In New England equals Approx. 19", Therefore

$$Qp_2 = Qp_1 \times \left(1 - \frac{STOR_1}{19}\right)$$

STEP 3: a. Determine Surcharge Height and "$STOR_2$" To Pass "Qp_2"

b. Average "$STOR_1$" and "$STOR_2$" and Determine Average Surcharge and Resulting Peak Outflow "Qp_3".

SURCHARGE STORAGE ROUTING SUPPLEMENT

STEP 3: a. Determine Surcharge Height and "$STOR_2$" To Pass "Qp_2"

b. Avg "$STOR_1$" and "$STOR_2$" and Compute "Qp_3".

c. If Surcharge Height for Qp_3 and "$STOR_{AVG}$" agree O.K. If Not:

STEP 4: a. Determine Surcharge Height and "$STOR_3$" To Pass "Qp_3"

b. Avg. "Old $STOR_{AVG}$" and "$STOR_3$" and Compute "Qp_4"

c. Surcharge Height for Qp_4 and "New $STOR_{Avg}$" should Agree closely

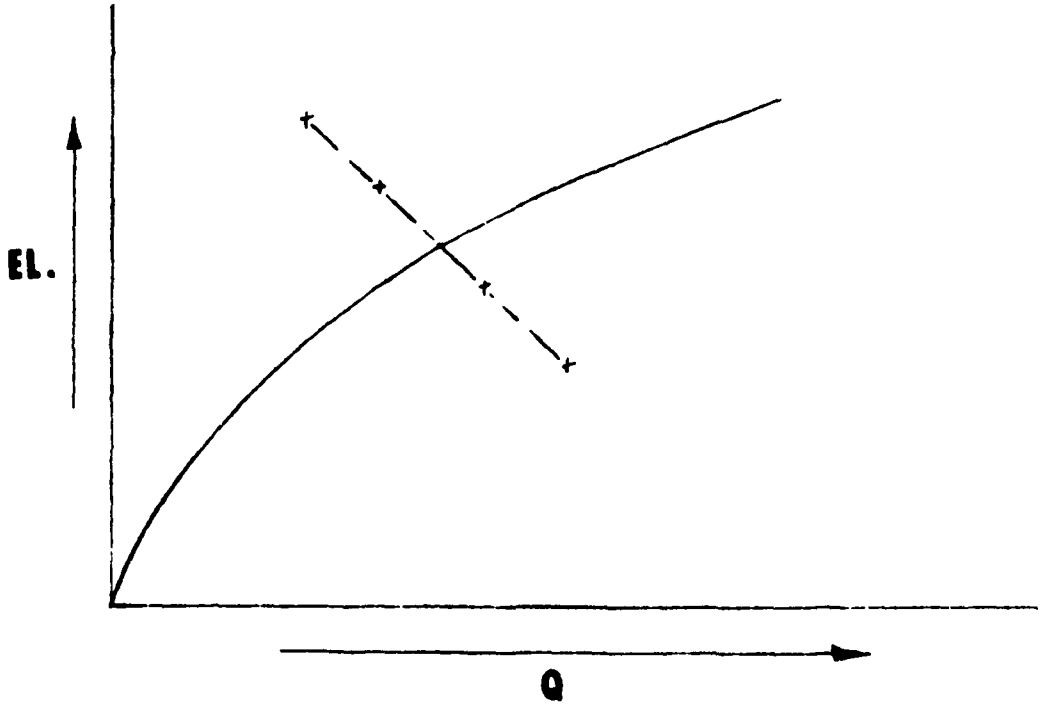
SURCHARGE STORAGE ROUTING ALTERNATE

$$Q_{p2} = Q_{p1} \times \left(1 - \frac{STOR}{19}\right)$$

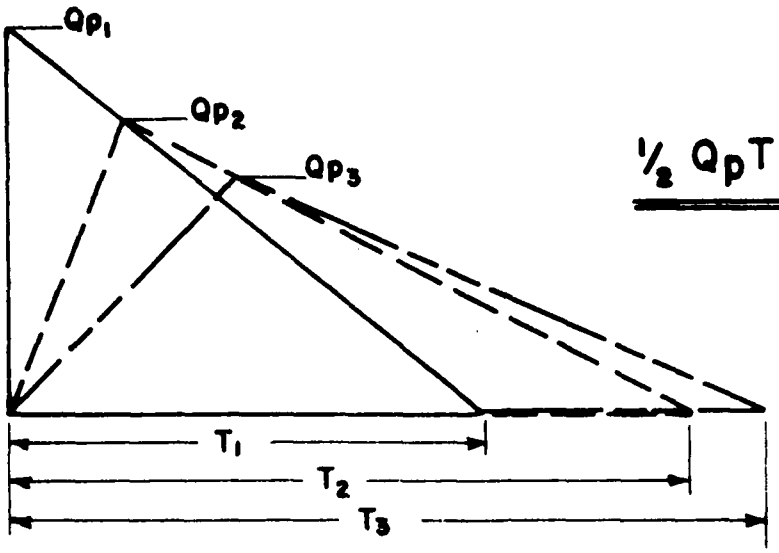
$$Q_{p2} = Q_{p1} - Q_{p1}\left(\frac{STOR}{19}\right)$$

FOR KNOWN Q_{p1} AND 19'' R.O.

Q_{p2}	STOR	EL.



"RULE OF THUMB" GUIDANCE FOR ESTIMATING DOWNSTREAM DAM FAILURE HYDROGRAPHS



$\frac{1}{2} Q_p T = 12 S$

STEP 1: DETERMINE OR ESTIMATE RESERVOIR STORAGE (S) IN AC-FT AT TIME OF FAILURE.

STEP 2: DETERMINE PEAK FAILURE OUTFLOW (Q_{p1}).

$$Qp_1 = \frac{8}{27} W_b \sqrt{g} Y_o^{3/2}$$

W_b = BREACH WIDTH - SUGGEST VALUE NOT GREATER THAN 40% OF DAM LENGTH ACROSS RIVER AT MID HEIGHT.

Y_o = TOTAL HEIGHT FROM RIVER BED TO POOL LEVEL AT FAILURE.

STEP 3: USING USGS TOPO OR OTHER DATA, DEVELOP REPRESENTATIVE STAGE-DISCHARGE RATING FOR SELECTED DOWNSTREAM RIVER REACH.

STEP 4: ESTIMATE REACH OUTFLOW (Q_{p2}) USING FOLLOWING ITERATION.

A. APPLY Q_{p1} TO STAGE RATING, DETERMINE STAGE AND ACCOPMANYING VOLUME (V_1) IN REACH IN AC-FT. (NOTE: IF V_1 EXCEEDS 1/2 OF S, SELECT SHORTER REACH.)

B. DETERMINE TRIAL Q_{p2}.

$$Qp_2(\text{TRIAL}) = Qp_1 \left(1 - \frac{V_1}{S}\right)$$

C. COMPUTE V_2 USING Q_{p2} (TRIAL).

D. AVERAGE V_1 AND V_2 AND COMPUTE Q_{p2}.

$$Qp_2 = Qp_1 \left(1 - \frac{V_{AVG}}{S}\right)$$

STEP 5: FOR SUCCEEDING REACHES REPEAT STEPS 3 AND 4.

APRIL 1978

APPENDIX E

INFORMATION AS CONTAINED IN THE NATIONAL INVENTORY OF DAMS

INVENTORY OF DAMS IN THE UNITED STATES

STATE	IDENTITY NUMBER	DIVISION	STATE	COUNTY	CONGR DIST.	STATE	COUNTY	CONGR DIST.	NAME	LATITUDE (NORTH)	LONGITUDE (WEST)	REPORT DATE DAY	MO	YR
CT	264	NED	CT	003	06				LAKE GARDA DAM	4144.7	7254.0	30	JUL	79

POPULAR NAME	NAME OF IMPOUNDMENT
	LAKE GARDA

REGION	BASIN	RIVER OR STREAM	NEAREST DOWNSTREAM CITY–TOWN–VILLAGE	DIST FROM DAM (MI.)	POPULATION
01	08	UNIONVILLE BROOK	UNIONVILLE	1	4000

TYPE OF DAM	YEAR COMPLETED	PURPOSES	STRUCTURAL HEIGHT (FT.)	HYDRAULIC HEIGHT (FT.)	IMPOUNDING CAPACITIES MAXIMUM (ACRE-FT.)	IMPOUNDING CAPACITIES NORMAL (ACRE-FT.)	DIST	OWN	FED R	PRV/FED	SCS A	VER/DATE
REPGOT	1930	R	20	17	293	173	NED	N	N	N	N	

REMARKS
20-ESTIMATE 21-CONCRETE COREWALL 22-RAISED TO EXISTING HIGHT 1946

O/S HAS	SPILLWAY CREST LENGTH	SPILLWAY TYPE	SPILLWAY WIDTH (FT.)	MAXIMUM DISCHARGE (FT.)	VOLUME OF DAM (CY)	POWER CAPACITY INSTALLED (MW)	POWER CAPACITY PROPOSED (MW)	NAVIGATION LOCKS NO	LENGTH (FT.)	WIDTH (FT.)	LENGTH (FT.)	WIDTH (FT.)	LENGTH (FT.)	WIDTH (FT.)	LENGTH (FT.)	WIDTH (FT.)
1	300	U	30	463												

OWNER	ENGINEERING BY	CONSTRUCTION BY
LAKE GARDA COMPANY INC	J D WILLIAMS CIVIL ENGR	HARRY BATTISTONI

REGULATORY AGENCY			
DESIGN	CONSTRUCTION	OPERATION	MAINTENANCE
CT WATER RESOURCES	CT WATER RESOURCES	CT WATER RESOURCES	CT WATER RESOURCES

INSPECTION BY	INSPECTION DATE DAY	MO	YR	AUTHORITY FOR INSPECTION
CAHN ENGINEERS INC	04	APR	79	PL 92-367

REMARKS

END

FILMED

9-84

DTIC